

AN
INTRODUCTION TO SURGERY



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INTRODUCTION TO
SURGERY:

BY

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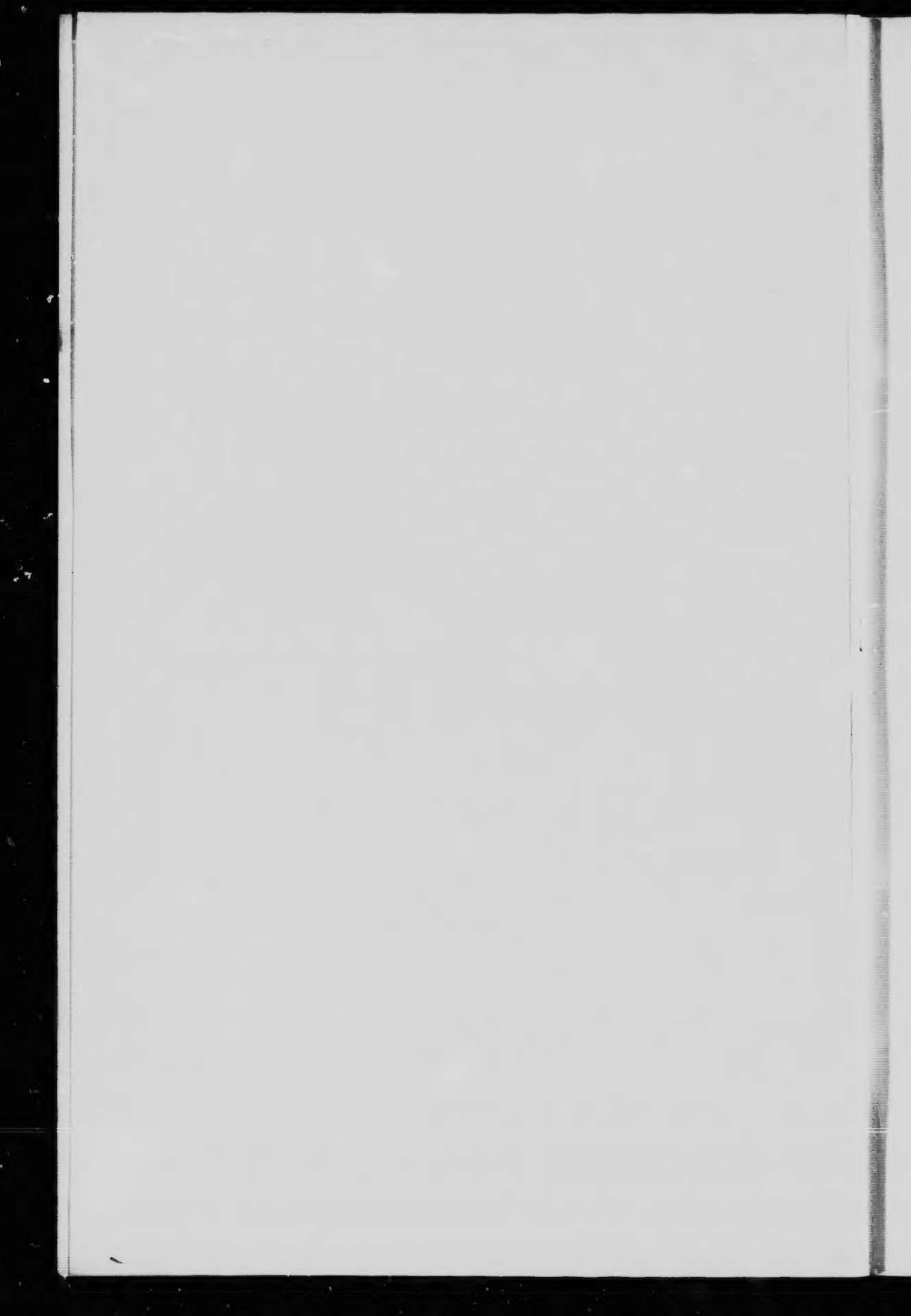
WITH 146 ILLUSTRATIONS IN THE TEXT, AND 5 COLOURED PLATES.

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PREFACE.

THE excellent surgical textbooks now available for the use of students have given rise to some doubts as to the need for a further instruction by means of systematic surgical lectures.

My own view is decidedly in favour of a course of lectures, provided that they are not mere abstracts from the textbooks, but are directed rather towards those main principles of diagnosis and treatment that are based on a sound knowledge of pathology. They should be aids to the student in thinking out for himself the pathological and diagnostic problems that are presented to him in the wards and in the textbooks. In order to do this, he must study these General Principles and understand the value of their universal application in so-called "special" regions, that is, to diseases affecting any portion of the body. As soon as the General Principles are understood, and their applicability realized, the student ceases to be overwhelmed by the masses of detail presented to him, and begins to feel an interest in subjects which before seemed surrounded by insurmountable difficulties.

It has been the chief object of my own lectures, of which the present book is an abstract, to emphasize the importance of these General Principles, and the fragmentary and dogmatic character of the teaching is due to the fact that my only intention is to provide a supplement to, not a substitute for, the standard textbooks.

So many students and friends have begged me to publish my views on Surgery, that I have been encouraged to express them in this form. It would have been impossible for me to do so in the limited time at my disposal but for the invaluable help given me by Dr. Boswell of Hartlepool, on whom I depended for the correction and revision of my rough proofs, and by Mr. F. C. Pybus, Surgical Registrar to the Royal Victoria Infirmary, Newcastle-upon-Tyne, to whom I am indebted for the greater number of the illustrations.

R. M.

Newcastle-upon-Tyne, November, 1910.



CONTENTS.

	PAGES
INFLAMMATION	1-18
Results of inflammation—Signs of inflammation—Terminations of inflammation—Suppuration.	
BACTERIA	19-32
Erysipelas—Gonorrhœa.	
ULCERS	32-42
Causes—Varieties—History—Treatment.	
GANGRENE	42-53
Causes—Line of Demarcation—Treatment—Gangrene from frostbite—Gangrene from ligature of arteries or embolism—Senile gangrene—Diabetic gangrene.	
SYPHILIS, TUBERCLE, AND MALIGNANT DISEASE	53-102
Ulcers—Tumours—Hodgkin's disease—Fibrosis—Sarcomata of bones—Septic infection—Syphilis—Diagnosis of chancre—Secondary syphilis—Tertiary syphilis—Congenital syphilis—Tuberculosis—Cancer—Sarcomata.	
HÆMOPHILIA	103
WOUNDS	104-111
Aseptic wounds—Accidental wounds.	
ABDOMINAL AND PELVIC VISCERA	111-141
The hollow viscera—Inversions and torsions—Strangulation—Idiopathic dilatation—Some functions of the omentum.	
INDICATIONS FOR OPERATION	142-149
Hæmorrhage—Sepsis—To remove a focus of disease.	
X-RAYS	150



Introduction to Surgery.

INFLAMMATION.

INFLAMMATION is no longer regarded as a disease, but as a "series of vital changes which occur in the tissues in response to irritation" (*Thomson and Miles*.) The causes are *predisposing* and *exciting*.

Predisposing Causes are—(1) *Local*; (2) *General*.

1. Of **Local predisposing causes**, defective circulation is the chief. As instances of this, varicose veins and arterial disease are to be specially remembered. Both diminish tissue resistance. Nerve lesions less commonly have the same effect. Traumatism is also a predisposing factor. A previous attack of inflammation in the same part diminishes its vitality, and predisposes to further attacks.

2. **General predisposing causes** are such as lower the bodily resistance. Malnutrition, old age, heart and kidney disease, diabetes, and alcoholism are the most important.

The known **Exciting Causes** of inflammation are :—

1. *Traumatic* : mechanical, chemical, electrical, x-ray, thermal (heat and cold), etc., stimuli.

2. *Microbic infection*.

The first may be thought of as implying a physiological, the second a pathological process.

Physiological Inflammation.—In the physiological variety the amount of reaction is chiefly determined by the quantity of the causative stimulus, in the pathological mainly by its quality.

Physiological inflammation (healing) ends when stasis (destruction) begins.

Repair.—In a clean incised skin wound there is only sufficient inflammation to aid repair, but there are :—

1. Oozing and coagulation of blood on the surface of a fine layer of bruised and dead tissue.

2. Underneath this capillary buds develop, and form capillary loops, surrounded by round cells (granulation).
3. The capillary loops of one side join similar loops on the opposite side, and the round cells become spindle-shaped (fibroblasts).
4. The surface is covered by new epidermis derived from the rete Malpighii.
5. Formation of fibrous tissue (scar).

The cells of which the granulation tissue is composed, do their best to reproduce the tissue from which they spring. Epithelium, fibrous tissue, and bone are reproduced to perfection. Liver cells and kidney cells are not infrequently replaced by new liver or kidney cells. Hair and nails grow only from remnants of their roots. Muscle, tendon, brain, and spinal cord cannot be reproduced, they are replaced by scar tissue.

That which occurs in a wound healing by "first intention" is typical of healing in every other *uncomplicated* wound. Without sepsis, granulations form; no pus, only more or less fibrous tissue, according to the size of the gap to be repaired.

Pathological Inflammation.—All **pathological** inflammations are the result of infection by microbes, and are characterized by these phenomena.

The first minute change observable in the damaged tissue is occasionally a transient contraction of the smaller blood-vessels.

The next is invariably dilatation of the blood-vessels, and increased vigour of the circulation within them.

Then follow gradual slowing of the circulation, oscillation of the blood in the vessels, and finally—

Stasis and thrombosis.

While retardation of the local circulation is proceeding, examine the contents of a blood-vessel: they will be seen to divide into a central current of red colour, in which movement is the more rapid, and a peripheral current, lighter in colour and moving less quickly.

The central consists chiefly of red corpuscles; the peripheral of liquor sanguinis and leucocytes.

When stasis is complete the red corpuscles cohere, and form a bright central axis.

The leucocytes tend to attach themselves to the vessel walls. "**Diapedesis**" follows adhesion of the leucocytes. They crawl through the vessel wall by means of amœboid movement, and escape.

In a short time the connective tissue surrounding the smaller blood-vessels is crowded with leucocytes, and distended by fluid exudate, which, when confined, causes swelling. When discharging into a cavity it implies the outpouring of a serous, sero-fibrinous, or

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PLATE I.



INFLAMMATION OF THE FINGER EXTENDING UP THE FOREARM.

hæmorrhagic or purulent fluid. When it finds its way to the surface it causes a corresponding discharge, or a croupous exudate, which may coagulate into a so-called "false membrane." The leucocytes are joined for purposes of defence by "free cells," always present in greater or less number in the connective tissue spaces. Both are described as "microphages." A third large cell derived from the connective tissue elements is called a "macrophage."

RESULTS OF INFLAMMATION.

At any stage the above-outlined processes may become arrested. Before thrombosis has occurred, the exudate and cells can disappear, the circulation become normal, and the tissues return to their original healthy condition.

1. *Resolution.*—

After the occurrence of thrombosis there must be more or less tissue destruction, and this results in—

2. *The formation of fibrous tissue :*
3. *Sloughing ; or*
4. *Gangrene.*

THE SIGNS OF INFLAMMATION.

The signs of inflammation are—(1) *Local* ; (2) *General*.

1. **The Local clinical signs of inflammation are—**

Redness,
Swelling,
Heat,
Pain, and

Loss of function. (*Plate I.*)

Redness is the result of hyperæmia. Except in the most acute inflammation, it may be invisible if the inflamed part is deeply situated. Enlargement of the surface veins may then suggest deep hyperæmia.

Swelling.—Though the swelling usually coincides with the inflamed area, this is not invariable. Thus, an inflamed scalp produces œdema of the eyelids ; an inflamed palm, swelling on the dorsum of the hand ; inflammation of the lower abdominal wall, œdema of the scrotum, etc.

Such swelling follows the path of least resistance, and these transferred swellings may be of considerable diagnostic importance. On the chest, for instance, or the abdominal wall, on the scalp, or surrounding a long bone, they suggest a deep-seated suppuration.

Heat results from increased blood supply.

SIGNS OF

It is an invaluable clinical sign, for it denotes active and progressive change. For example, if a swollen joint is hot, it requires rest. If it is cold, there is no need for such care.

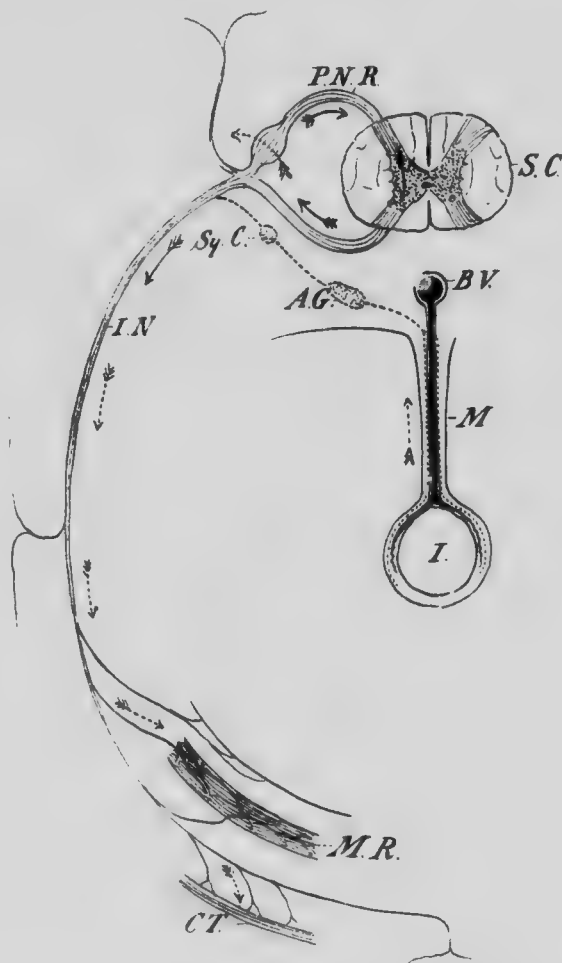


FIG. 1.—DIAGRAM TO ILLUSTRATE REFERRED PAIN IN INTESTINAL LESION, and also superficial tenderness and muscular rigidity. The dotted arrows and lines indicate the probable course of the impulse through the posterior root ganglion. The black arrows indicate alternative route through the spinal cord. (P.N.R.) Posterior nerve root, (S.C.) Spinal cord, (Sy.C.) Sympathetic cord, (A.G.) Abdominal ganglia, (B.V.) Blood-vessel, (I.N.) Intercostal nerve, (M.) Mesentery, (I.) Intestine, (M.R.) Muscular rigidity, (C.T.) Cutaneous tenderness.

Pain results from tension. It is increased by dependency, and relieved by elevation of the inflamed part; and the more resisting the structures in which it occurs, the greater the pain.

The character of the pain may give a hint as to the structures involved.

Thus, a boring, aching pain, worse at night, suggests bone inflammation.

Mucous membranes "smart." Serous membranes "stab."

A "sickening" pain suggests testicle, kidney, mamma, or ovary.

Apart from the consideration of involved structures, a "throbbing" pain suggests suppuration.

Pain may be "referred" and misleading (*Fig. 1*). The following are instances:—

Kidney pain may be felt in the testicle; spinal pain in the abdomen; hip pain in the knee; rectal pain in the penis; eye pain in the head; intestinal pain at the umbilicus.

The most *tender spot* indicates the position of greatest mischief. e.g., pressure with the point of a probe will demonstrate the best spot for an incision in a case of palmar abscess; and point pressure with the finger may suggest that inflammation of the gall-bladder or of the appendix is the cause of an obscure abdominal illness.

Impairment of function is due either to pain or to mechanical effects, and may be the most important indication of inflammation. Thus, if a child walks lame, or the movements of one of its joints are impaired, inflammation is to be suspected.

2. The General signs of inflammation comprise the various features of inflammatory fever: A quick pulse; increased tissue metabolism, shown by excessive excretion of urea and urates; general impairment of all the organic functions (digestion, secretion, excretion; and of nervous, mental, and muscular adequacy).

TERMINATIONS OF INFLAMMATION.

Local.—In all essentials they are the same in each structure; they are:—

1. *Resolution.*
2. *Thickening*; fibrosis in the soft parts, sclerosis in the bones.
3. *Partial Destruction*; ulceration, caries, sloughing, pus formation.
4. *Total Destruction*; gangrene, necrosis.

Bearing these facts in mind, it is not difficult to understand the happenings in inflammation. Thus, in a boil, the hot, painful, swollen, red spot may quickly and entirely disappear; or it may threaten mischief, and then subside, leaving a permanent firm nodule of fibrous tissue (blind boil). It may suppurate and slough

TERMINATIONS OF



Fig. 2.—AREAS IN AN ADVANCING BOIL.

- (1) Central slough. (2) Layer of pus; dead leucocytes. (3) Dense layer of partially-necrosed tissue infiltrated with leucocytes. (4) Area of vascular stasis with diapedesis. (5) Area of sloughing with diapedesis. (6) Area of acceleration. (7) Normal tissue.

INFLAMMATION

7

(discharge a core) in the centre. Or it may develop gangrene of the entire inflamed area, as in facial carbuncle (*Fig. 2.*)

An inflamed joint (arthritis) may be restored to normal; may heal, with fibrous adhesions; suppurate; or may be entirely destroyed.

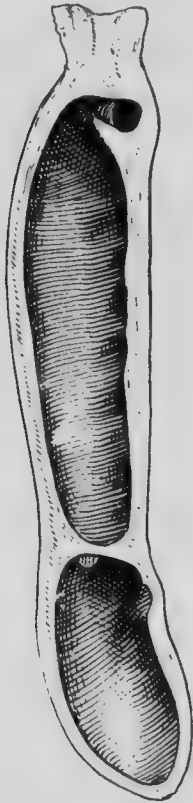


Fig. 4.—PARTIAL FIBROSIS.

Stricture near the base leading to cystic dilatation.



Fig. 3.—FIBROSIS.

Appendix after nine attacks of inflammation. A mere fibrous cord. No lumen. Just possible to differentiate the coats.

The inflamed vermiform appendix (appendicitis) may recover completely; may become fibrosed (*Figs. 3 and 4*) (stricture and thickening); may suppurate, or slough (*Fig. 5*); or total gangrene may result (*Fig. 6*).

An inflamed bone may recover completely; may become sclerosed (*Fig. 7*); partially die (caries, cario-necrosis, partial necrosis, *Fig. 8*); or may die entirely (total necrosis, *Fig. 9*).

General (Inflammatory) Fever.—Is classified under three heads:—

Acute or chronic sapraemia—implying the absorption of toxins alone into the blood-stream.

Septicamia—involving the entrance of organisms into the blood.

TERMINATIONS OF

Pyæmia—or development of secondary foci, carried as emboli by the blood-stream.

When septic particles (emboli) reach the general circulation, which they chiefly do as a consequence of the breaking down and detachment of protecting thrombi, a series of clinical signs and symptoms results which is sufficiently characteristic for purposes of diagnosis. The conditions thus indicated are either those of pyæmia, or of malignant endocarditis.

Pyæmia, thirty years ago, was one of the most ordinary of surgical diseases; now, thanks to the genius of Lord Lister, it is one of the rarest results of operations. The traumatism generally associated with it were compound fractures and open operations on bone: probably for the reason that the bone veins, relatively large and patulous, are held open by the walls of the bony canals through which they run, making absorption easy, while at the same time they have no valves to localize the clotting. Probably, also,

the unyielding bone forces the

septic inflammatory products into every available outlet.



FIG. 5.—ACUTE INFLAMMATION OF THE APPENDIX.

Partial necrosis. Perforation opposite stercolith. The terminal inch almost gangrenous.



FIG. 6.—TOTAL NECROSIS.

Appendix on glass rod. Complete slough, which floated out on evacuating an appendix abscess.

At the present time the commonest cause of pyæmia is *suppuration in the middle ear*. With or without an infection of the petrous



Humerus.

Section of Tibia.

Fig. 7. - SCLEROSIS. DIAPHYSEAL OSTEITIS.



FIG. 8.—PARTIAL DESTRUCTION.
Caries of lower end of femur



FIG. 1. TOTAL DESTRUCTION (NECROSIS). TIBIA, ACUTE OSTEITIS.
Entire separation of periosteum from diaphysis; separation of epiphysis.

TERMINATIONS OF

bone or mastoid, some of the small veins in connection with the tympanum become thrombosed, and the thrombus infected. The process extends either through the petrosal, or directly into the lateral sinus, where the infected vessels empty, and detached portions of the infected clot are conveyed by the internal jugular vein into the general circulation (*Fig. 10*). The first and the smallest of these clot fragments are probably destroyed in the circulating blood; but sooner or later one of them is arrested in the lungs, causing thrombosis (infarct) and suppuration (abscess) at its seat of arrest. If the patient lives long enough, secondary infection of the joints (pyæmia) may be confidently expected.

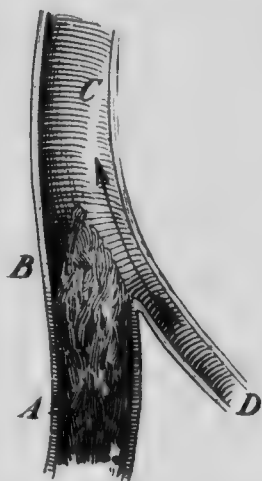


Fig. 10. — PYÆMIC EMBOLI.

(A) Vein thrombosed. (B) Apical portion of clot, softer than the rest. (C) Patent portion of vein. (D) Tributary.

The next most common cause is perhaps *appendicitis*. Here a septic phlebitis and thrombosis of the veins of the meso-appendix gives rise, in a manner corresponding with that just

described, to secondary abscesses in the liver. Then we should

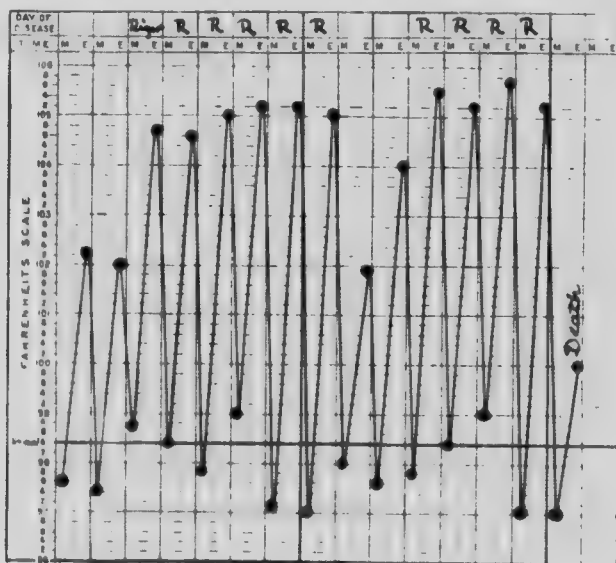


FIG. 11. — CHART. — Pyæmia. Lateral sinus thrombosis.

remember the connection—on similar lines—of septic infection of the hæmorrhoidal veins with abscesses in the liver, and of septic thrombosis of the ovarian and uterine veins with puerperal pyæmia.

The clinical evidence in typical cases of septic thrombosis is unmistakable. The first sign is a rigor of unusual severity. This is usually accompanied by a considerable rise in temperature. Very soon after the rigor has passed off, the patient feels and looks quite



Fig. 12. -PYEMIC ABSCESS IN THE LUNG.

Diagram illustrating its formation. Following infarcts, the result of emboli. Thrombosis of axillary vein. Axillary abscess.

well again, and so continues (*Fig. 11*) till the next attack, which usually occurs within twenty-four hours.*

Only after a repetition of the rigors—and it may be after many days and many rigors—does any further sign of serious illness make its appearance; sooner or later, secondary abscesses develop in the viscera (*Figs. 12 and 13*), and if the patient continues to live, the joints are then invaded. For several years I have had the belief impressed upon me by watching many cases, that daily recurring rigors mean circulatory sepsis arising from some local septic focus,

* Recurring daily rigors suggest circulatory sepsis.

which ought to be discovered, and must be diligently sought for. The rigors cannot be due to anything but repeated doses of sepsis, because they are at once arrested if the circulation in the chief veins leading from the infected area can be stopped.

Ligature of the internal jugular vein in septic thrombosis of the lateral sinus consequent on middle-ear suppuration affords the

best known illustration of the importance of this knowledge. The same operation teaches other important lessons. The importance, not sufficiently recognized, of the primary focus.

It will be further emphasized in connection with tubercle, syphilis, and malignant disease. The facts to be remembered are, that if the primary focus can be cut off from the larger venous trunks, further septic infection will be prevented; that healing of those secondarily infected areas already in existence can occur; and that recovery may follow an apparently desperate illness.

That this has been no chance occurrence, nor peculiar to exceptionally strong individuals, is proved by an extended experience. I have seen patients with both lung abscess and joint abscesses, secondary to middle-ear suppuration, recover after

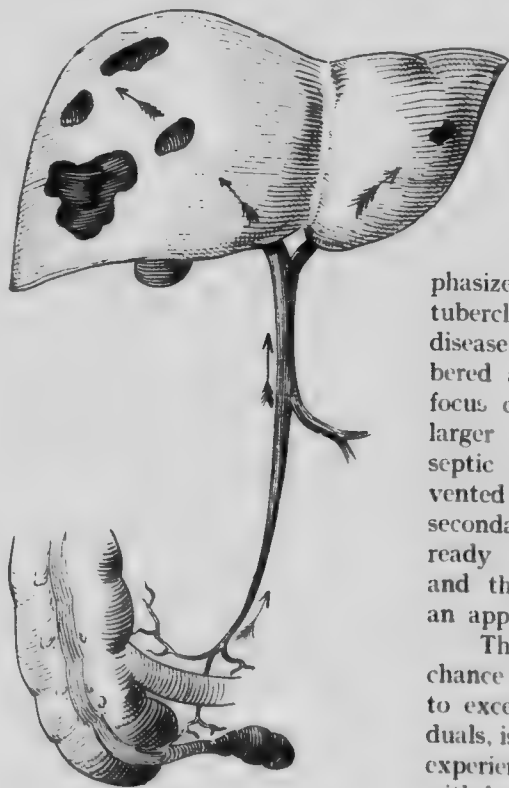


FIG. 13.—PORTAL PYEMIA.
Gangrenous appendix. Emboli via portal vein.

ligature of the internal jugular vein; but have never seen another joint infected, or any further invasion after the primary focus had been cut off from the circulation. The operation is an imitation of nature's cure—a cure which occurs more often than is known to those who have not made post-mortem examinations bearing upon it. Some years ago, when specially interested in the subject, I made examinations on several patients with middle-ear suppuration, or the relics of it, and who had died from other causes. It was a surprise

to me to find how often the lateral sinus had been obliterated by old inflammation.

Another important lesson derived from experiences in connection with middle-ear suppuration, is the connection between circulatory sepsis and inflammation in joints. It seems probable that the accepted explanation as to the joint changes resulting from embolic infection is the correct one. It is certain that "pyæmia" may cause changes in the joints, varying from the mildest arthritis to the most destructive form of joint inflammation, and that the terminations may resemble those of any of the long-named and ill-understood inflammatory joint diseases, such as rheumatoid arthritis, osteo-arthritis, chronic rheumatism, etc.

Recent investigators have, in some instances, shown the close connection of these conditions with sepsis, and the possibility that many of them arise in this way has been conjectured.

Surgical experience suggests that they all arise from a primary septic focus; that they are all embolic; and that treatment should be first directed to the discovery of, and action against, the primary focus.

Three forms of acute multiple arthritis have been differentiated, and are well known and described. Their distinctions and differences are fully accentuated; but a fair comparison shows that the resemblance each bears to the other is more marked than the differences, and that in all essentials, their pathology—except in reference to the attacking organism—is the same.

They are due to *acute rheumatism* (rheumatic fever), *gonorrhœal rheumatism* (gonorrhœal arthritis), and *pyæmia*.

All have a primary focus from which they originate. Its favourite site is, for rheumatic fever, the tonsils; for gonorrhœal arthritis, the urethra; and for pyæmia, the bones. In each, the primary focus may be relatively insignificant. In all, the infective organism is a coccus, with the common tendency to run into clumps. (Is this the explanatory embolic infection?) In all, the larger joints are the most likely to be attacked. All of them may infect the serous membranes of the heart; or lungs; or eye.

In rheumatism the heart and serous membranes are frequently infected; in gonorrhœa and pyæmia they are rarely invaded.

In rheumatism and gonorrhœa the lungs are seldom infarcted; but in pyæmia they frequently are.

In rheumatism and pyæmia the eye is seldom involved; but in gonorrhœa the iris is frequently, and the conjunctiva not seldom, attacked.

The skin is apt to be affected, and erythematous or purpuric rashes are common to all.

The fibrous tissues frequently present fibrous nodules in rheumatism; and a favourite site is behind the elbow. Gonorrhœa frequently affects the fibrous tissues with a diffuse inflammatory thickening, a favourite site being the plantar fascia, and also the neighbourhood of the insertion of the tendo Achillis. Pyæmia not infrequently causes large abscesses in connection with the deep fascia, especially of the limbs.

Acute rheumatic arthritis is transient, seldom lasting more than three weeks; is influenced favourably by salicylates; very rarely terminates in suppuration; and seldom leaves permanent damage. Gonorrhœal arthritis lasts indefinitely; and is uninfluenced by salicylates; suppuration often threatens; it may appear to be imminent, but is actually infrequent; and a crippling, painful, permanent stiffness frequently results.* Shreds in the urine may be the only evidence of the primary infection. Pyæmic arthritis—unlike rheumatic or gonorrhœal arthritis—is seldom acutely painful; often almost painless; nearly always terminates in suppuration; and unless treated early, is likely to result in ankylosis.

A first attack of acute rheumatic arthritis is rare in patients over twenty years of age; gonorrhœal and pyæmic arthritis are unusual before that age.

Acute Inflammation, so far as is now known, is always caused by infection with a pyogenic organism.

In a healthy person these organisms have a difficulty in establishing a footing. In a debilitated subject, however, or amongst injured tissues, a slight infection may prove serious.

Chronic inflammation has for its two best-known causes the organisms of tubercle and syphilis.

Conditions between the two, neither acute nor chronic, are generally the result of an attenuated pyogenic organism, or of a mixed infection.

The most acute infections are generally conveyed from or through the skin, the less acute through the blood-stream.

It is increasingly possible to successfully guess the infecting organism by a number of clinical signs, which, however, have been as yet insufficiently worked out. The staphylococcus pyogenes aureus may be expected in localized inflammations, such as boils, carbuncles, abscess, and septic osteitis; and the pus in such instances is yellow and creamy, with a mawkish odour. The streptococci, by

* Always suspect gonorrhœa as the cause of an acute arthritis which has resisted salicylates, in which the skin covering the joint is red and œdematous, and especially one accompanied by iritis.

their tendency to cause a spreading inflammation, probably extending to the lymphatics (red streaks above the wound indicate this), and to the lymphatic glands or the blood-stream, with a pus which is sero-fibrinous and without odour. The tubercle bacillus, from the chronic nature of the inflammation it causes, by its tendency to affect the lymphatic glands, the joints, and bones, and by its curdy pus. The bacillus coli, from its proximity to the abdominal viscera, and its faecal-smelling pus. The typhoid bacillus, from its tendency to cause inflammation of the ribs, or thyroid gland, or gall-bladder. The pneumococcus, as causing in little girls an otherwise unaccountable peritonitis with abundant pus formation.

To ascribe inflammation, the cause of which is at present unknown, to traumatism, rheumatism, or gout, is at times convenient. We should recognize that we only use these terms in this connection in order to cloak our ignorance.

SUPPURATION.

An acute inflammation which has lasted more than four days, almost certainly terminates in suppuration, of which two common types may be recognized :—(1) *Localized*,—*abscess* ; (2) *Diffuse*,—*cellulitis*.

1. **Abscess.**—The cause may be a direct infection, e.g. through the skin ; through ducts (mammary abscess is an instance) ; through lymphatics into glands ; or by the blood-stream into internal organs.

Round the area of infection there is a large collection of cells, which form a protective barrier, and attack the invading organisms.

At the centre of infection the accumulation of bacterial toxins causes tissue death, and kills the cells ; while the exudate is liquefied by ferments set free from dead leucocytes, the whole product forming pus.

Round the pus is a dense wall of cells and condensed tissue, causing tension within. The larger blood-vessels surrounding the inflamed area are thrombosed (*Fig. 14*).

The pus burrows in the direction of least resistance. Pointing and escaping, it carries with it invading organisms. When the pus escapes, the tissues should produce healthy granulations, which heal up the abscess cavity.

Sinus.—If anything, such as a foreign body or a piece of dead tissue, prevents the healing, a tubular ulcer (sinus) results (*Fig. 15, B*).

Fistula.—The pus may escape through more than one opening, and if one of these is into a canal lined by mucous membrane, while

the other is through the skin, the resulting tubular ulcer is called a *fistula* (Fistula in ano (*Fig. 15, A*), salivary fistula, etc.).

The local signs of an abscess, in addition to those common to all inflammations are, œdema of its surface-covering, and fluctuation of the centre of the localized inflamed area, with throbbing pain.

2. Cellulitis. — Infection occurs through the skin, often by a trifling wound or prick, and spreads through the cellular tissue spaces and lymphatics. Most mischief may consequently result at some distance from the point of infection (e.g. a prick on the finger may result in an arm or axillary abscess). Pus infiltrates the meshes of

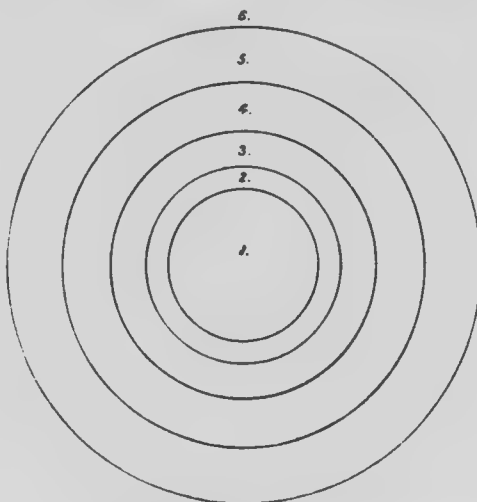


Fig. 14.—AREAS IN ACUTE ABSCESS.

(1) Collection of pus. (2) Layer of necrosed tissue full of organisms and leucocytes. (3) Tissue with vascular stasis and diapedesis. (4) Tissue with vascular retardation and diapedesis. (5) Tissue with vascular acceleration. (6) Normal tissue.

the cellular tissue, and by disturbing the vascular supply, causes death of fasciæ, tendons, and overlying skin, escaping finally by many openings.

The local signs of cellulitis are : a diffuse, boggy, dusky, tender swelling of the skin, red lymphatic streaks, and enlarged tender lymphatic glands above the seat of infection.

The general symptoms of pus formation are : a rigor at the commencement, followed by fever and leucocytosis.

In the diffuse variety, the constitutional disturbance may be so severe as to cause death from septicæmia a few hours after the signs

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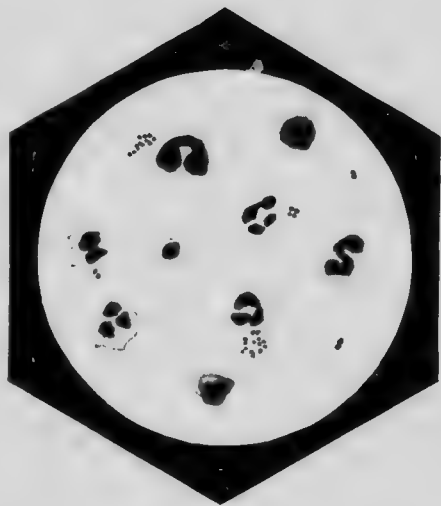


FIG. A. — PUS FROM CARBUNCLE OF NECK.
Showing staphylococci. Diplococcal and tetrad forms.
Bunches.

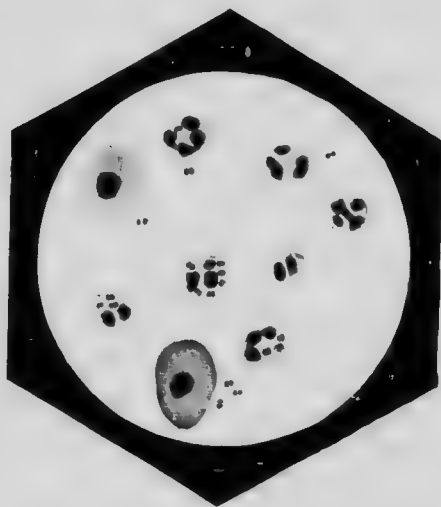


FIG. B. — PUS FROM URETHRA.
Showing gonococci in leucocytes and free squamous urethral
cells.

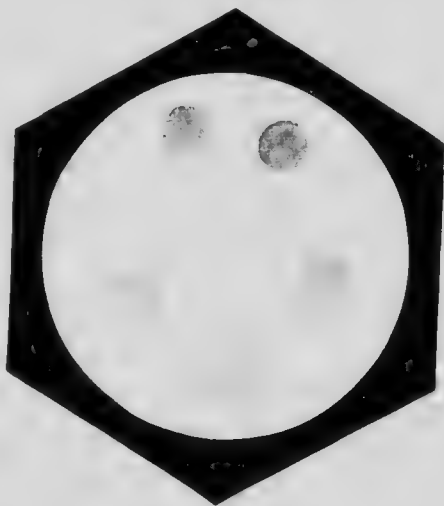


FIG. C. — SPIROCHETA PALLIDA.
From a case of syphilis.

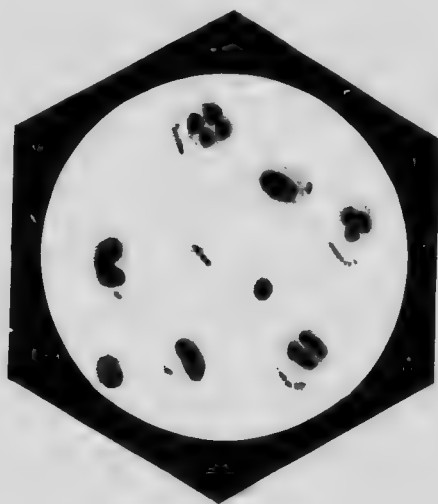


FIG. D. — STREPTOCOCCI IN PUS
From a case of infective mammitis.

of local infection have been observed. It is this variety, moreover, which is responsible for the not rare occurrence of secondary hamorrhage, through erosion of blood vessels.

BACTERIA.

Sepsis, in surgical language, means infection by pyogenic organisms.

Asepsis is the term applied to conditions in which bacteria are absent.

Sterilization, to processes for killing bacteria by heat.

Antiseptic is the term which applies to the destruction or inhibition of bacteria by chemicals.

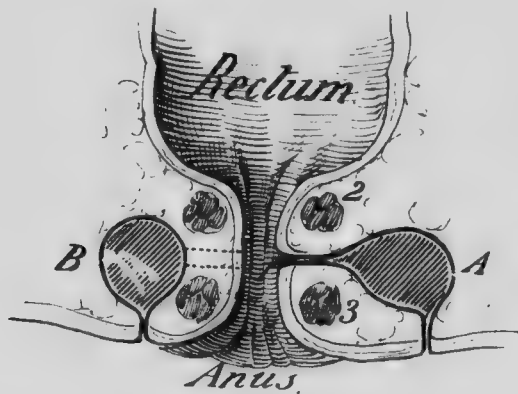


FIG. 15.—LOWER END OF RECTUM.

(A) Fistula in ano. (B) Sinus (blind external fistula). (1) Anal canal. (2) Internal sphincter ani. (3) External sphincter ani.

Bacteria.—(Plate II.)—Three divisions are recognized :—

1. **Cocci.**—Small spherical organisms, in pairs; diplococci, in chains; streptococci, in clumps; staphylococci, etc.
2. **Bacilli**, or rods.
3. **Spirilla.**—Spiral rods. Of these, spirochaetes are the most important.

They may be reproduced by division or by sporing.

Conditions of Growth.—They require food—proteid and carbohydrate—and certain salts. An alkaline medium favours growth. They also require moisture; and all dehydrating agents, such as sugar, salt, and alcohol, stop their growth. Hence the employment of these agents as preservatives. They do not grow in pure water; but may live for a long time in it. Some require oxygen (aerobic

bacilli). Others cannot live in it (anaerobic). The great majority can live either with or without it, and are called facultative anaerobes.

The temperature of the human body is that best suited to bacteria. Boiling kills all of them, and their spores. Cold makes them inactive. Sunlight is inimical to them.

Microbes are, in a sense, man's constant companions. In the air, they are carried by dust particles; tap-water contains them in abundance; the skin; unpurified clothing; the soil; exposed surfaces; may all be counted upon to supply contributions.

Bacteria which only live on dead matter are known as *saprophytes*; those that grow in living tissues as *parasites*.

If bacteria are regarded as the seed, and the body the soil on which they grow, many difficulties in the way of understanding their action will disappear. With an active and plentiful crop of bacteria, and tissues well prepared to receive them, a virulent attack of disease will follow. With the reverse conditions, a small or no visible effect will be produced by the introduction of micro-organisms to the body.

When they gain an entrance into the body they may remain localized in the neighbourhood of their point of entrance, or become distributed to other parts. The organisms of tubercle, for example, may be localized as cold abscess, or distributed to joints, viscera, bones, or skin.

Settled in their chosen site, they commence the manufacture of **toxins**, which produce poisonous effects, locally and generally. The local effects are generally cell-destruction, and all of those changes included in the term "inflammation." The general effects of absorption of the toxins of the pyogenic organisms are those described as acute and chronic sapræmia, and inflammatory fever.

Organisms seldom, if ever, multiply in the blood-stream of human beings.

In the body, their death may be brought about by accumulation of their own toxins, as well as by other agencies to be specified.

Outside of the body, they and their spores may be killed by exposure to dry heat of 170°C . for $3\frac{1}{2}$ hours; by boiling water in 5 minutes (some spores require $1\frac{1}{2}$ hours); by steam at 100°C . in 15 minutes (some spores require $1\frac{1}{2}$ hours); or by germicides, such as carbolic acid, perchloride, biniodide, and cyanide of mercury.

Certain substances called **antiseptics**, such as boracic acid and weak solutions of carbolic acid, or mercury perchloride, prevent the growth of organisms (inhibit).

Permanent Microbic Infection. — An infection by organisms may, and frequently does, continue as a life-long possession. Their

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PLATE III.

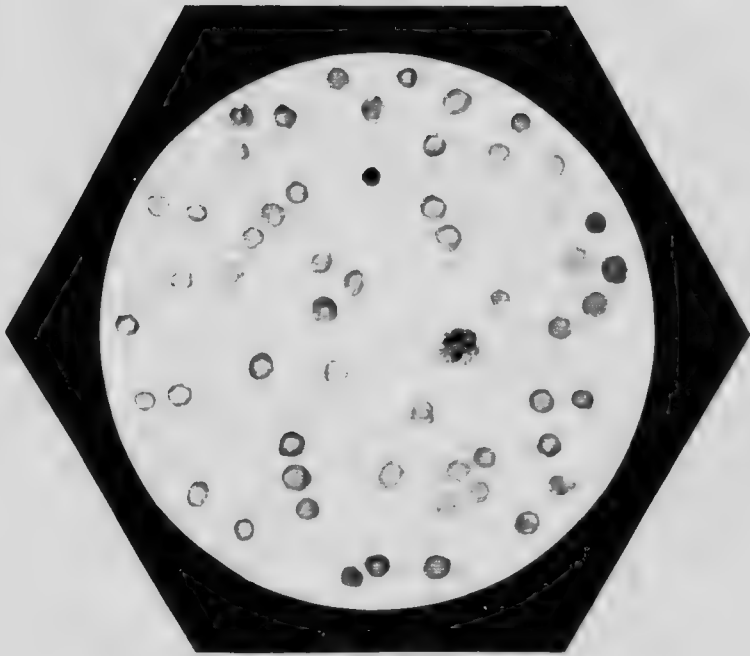


FIG. A.—BLOOD FILM, NORMAL.

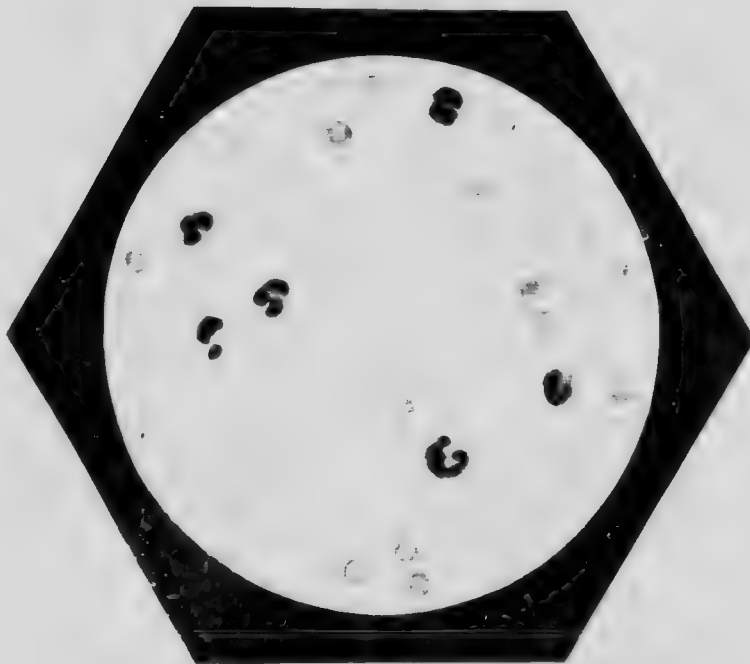


FIG. B. LEUCOCYTOSIS. From a case of lateral sinus thrombosis.

imprisonment in the body may, under ordinary conditions, prevent them from working mischief; but it is possible for them to assert themselves from time to time during the whole course of a long life.

The following case of permanent bone infection, commencing with osteitis of the tibia at the age of 15, to be followed by what was treated as chronic rheumatism for fifteen years, and culminating in acute osteitis of the humerus at the age of 47, well illustrates this fact.

CASE I.—T. D., aged 47, a miner, was admitted to the Royal Victoria Infirmary for swelling of his left arm. Eight weeks ago he had pain in the lower part of his arm, which later became almost unbearable. A swelling appeared. This was incised, and pus was evacuated, leaving a sinus on the outer side of his arm. For the last fifteen years he had been treated for rheumatism of the arm. He had osteitis of leg (right), when 15 years of age. There was a long typical bone scar over the front of the tibia. On admission, the patient was pale and ill. Temperature 102° F.; pulse 104. The lower half of left arm was swollen and cedematous, and there was a sinus on the outer side with much purulent discharge. Leucocytosis, 25,000.

Operation.—Nov. 12, 1907. A free incision was made over the diseased area, and the bone was fractured during the manipulations. The wound was packed with gauze. The arm continued to be painful, and the fever remained.

Operation.—Nov. 20, 1907. Amputation at shoulder-joint. The upper half of the humerus was brittle from inflammation. The shoulder-joint was infected, and the joint surfaces were covered by granulations. Section showed a diffuse osteitis of both upper and lower fragments of the humerus. Recovery.

Another fact to be remembered is, that occasionally micro-organisms show a marked predilection for certain tissues; for example, in some patients, the skin; in others, glands; bones; or joints alone, are attacked.

Leucocytosis.—Normal human blood has an average of 7,500 leucocytes per cubic millimetre; above 12,000 may be regarded as abnormal (*Plate III, Figs. A and B*); and 40,000 as implying an exceptionally high degree of leucocytosis. After the invasion of the body by bacteria, the number of leucocytes in the blood is increased. In all surgical infective diseases leucocytosis may be expected, and this knowledge may be a valuable aid in diagnosis or prognosis. After the first rise in temperature, leucocytosis should be present, increasing as the infection progresses, diminishing steadily as it recedes, and increasing again if suppuration follows.

If the number of granular polymorphonuclear neutrophile leucocytes (for it is with this variety chiefly that surgeons are concerned) is increased, bacterial infection is suggested as the cause of illness.

As a watch-dog for the formation of pus, leucocytosis may be invaluable; the *absence* of it in infections where it might have been expected suggests a serious condition, and is strong confirmation of a prognosis already grave from other signs.

Defences of the body against micro-organisms :—

1. The healthy unbroken skin externally, and the mucous membranes internally, are the most powerful defences of the body against the attacks of micro-organisms.

2. Mucus secretions, in addition to their mechanical protection, probably act as antiseptics.

3. When either skin or mucous membrane is damaged, microbes may at once gain admittance; but they may also be immediately washed out of the wound by the escaping blood, which, moreover, by its clotting in and around the wound, imposes an obstacle to their further entrance, and thus affords protection where most needed.

4. When an effectual entrance has taken place, the inflammatory reaction which follows, results in the production of a temporary barrier, which may stop invading organisms from reaching the circulating blood.

5. The temporary barrier of condensed inflammatory tissue thus interposed may become organized (fibrosis or sclerosis), and imprison the organisms indefinitely (permanent infection).

6. Should the organisms, however, in defiance of these defensive processes, succeed in reaching the blood-stream, they are combatted :—

(a). By the production of antibacterial substances in the blood serum.

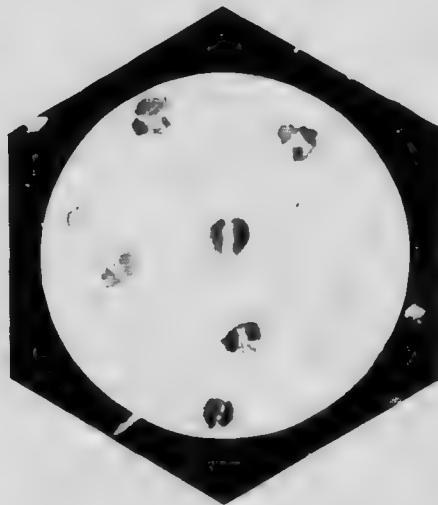
(b). By agglutination of the bacteria in clumps.

(c). By phagocytosis.

a. *Antitoxins*.—Certain organisms, such as those of tetanus and diphtheria, kill by the production of toxins, which toxins alone are sufficient to produce the same disease as the organisms themselves, and with fatal results. Moreover, a dose of the toxin, just as well as of the microbes, introduced into the blood of an animal, causes the formation of an antidote. The antidote, or "*antitoxin*," in the serum of an animal so treated, may be used as an aid to treatment; but it does not kill microbes. These are destroyed by a different method.

Vaccines.—If dead microbes are injected into the circulation, they prevent, or inhibit, the growth of similar germs in the blood. Such blood may be directly poisonous to the special micro-organisms, or cripple their activities. The bactericidal substances

PLATE IV.



SLIDE PREPARED FOR OPSONIC INDEX.
Showing tubercle bacilli in leucocytes.

are diminished in blood taken from the body, and so treated: and are, on the other hand, increased in the circulating blood, which proves that these substances are generated in the body by this stimulus.

b. Agglutination.—Blood may cripple the bacteria by agglutinating them together in clumps. (Practical use of this knowledge has been made in connection with the diagnosis of typhoid fever.)

c. Phagocytosis.—The most important defence of the body is that offered by the phagocytes (white cells). They try to devour and destroy all intruders, and upon their success or failure the result depends. The phagocytes, however, require to circulate in a serum which will tempt them to attack the enemy.

Opsonic Index.—Calculation of the opsonic index is based upon this knowledge. (Plate IV.) A certain number of bacteria are exposed to the action of a certain corresponding number of phagocytes for the same period of time, in (1) normal serum, in (2) serum from the patient. Slides are made and stained, the number of microbes in each phagocyte is counted, and an average obtained of the number ingested in each case. The ratio of these numbers—the opsonic index—shows to what extent the patient's blood is more or less active in attacking the bacteria than is normal blood.

The opsonic index is normally raised by the injection of dead microbes into the body: and the treatment by vaccines is based on this principle.

Microbes are seldom free in the blood. In the body, they are usually imprisoned by a wall of inflammatory tissue, awaiting an opportunity for mischief. Under such circumstances, dead microbes injected into healthy tissues stimulate the phagocytes to attack these intruders, and to disturb the peace of the quiescent focus.

Vaccine treatment has so far been most successful in the more chronic localized infections: and it has to be remembered that each inoculation only affects the special microbe for which it has been made; indeed, so specialized are microbic infections that, to get the best results, it is necessary to use the patient's own microorganisms.

The Iodine Glycogen Reaction.—In most surgical infections, some of the polynuclear leucocytes will be stained brown with a mixture of watery solution of iodine and iodide of potassium.

Temperature and pulse are, for clinical purposes, graphically recorded on charts, which show at a glance the correspondence of these important signs with the other features of a case, and with the course it is taking (*Figs. 16 to 25*).

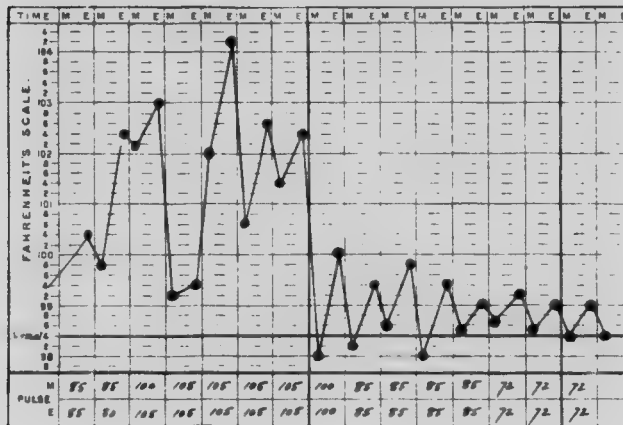


Fig. 19.—CHART.

M. R., age 23, female. Pelvic cellulitis. Recovery.

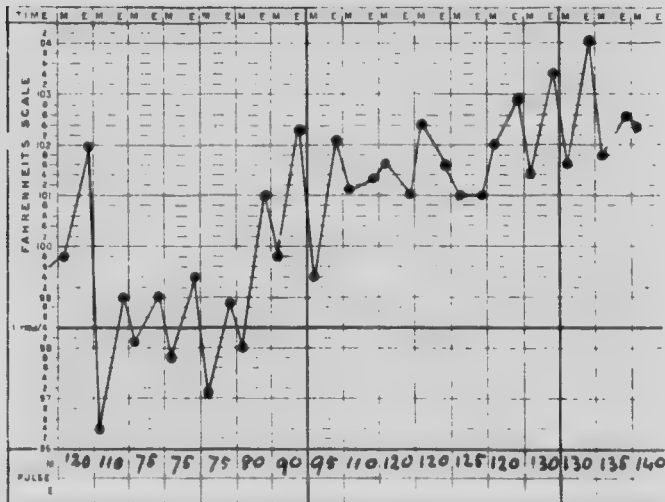


Fig. 20.—CHART.

R. H., age 43, male. Diffuse cellulitis following wound of hand. Death.

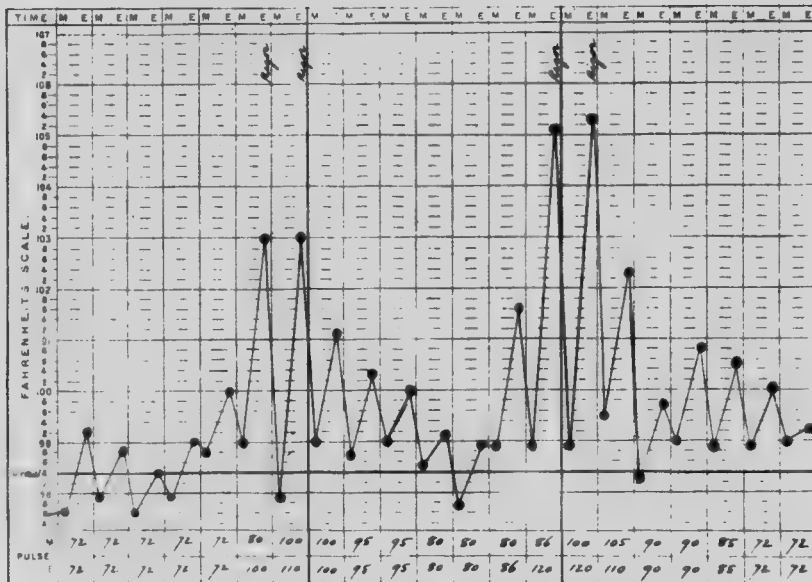


FIG. 21.—CHART.

J. G., age 38, male. Fractured spine. Bladder sepsis.

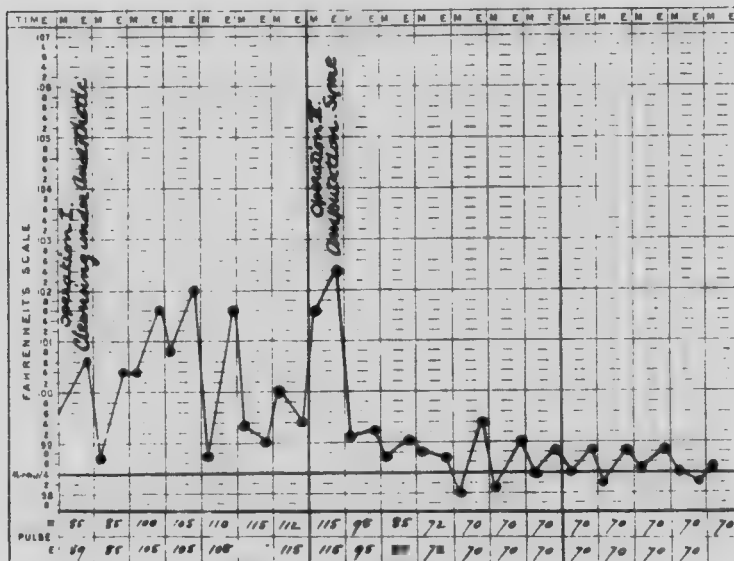


Fig. 22. CHART.

J. G., age 37, male. Compound fracture of foot. Gangrene. Amputation.

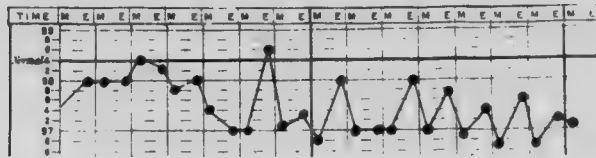


Fig. 23.—CHART.

C. B., age 74, male. Senile gangrene. Aseptic. Spontaneous separation of toe. Calcareous arteries. Pain, tingling, and numbness for 10 years.

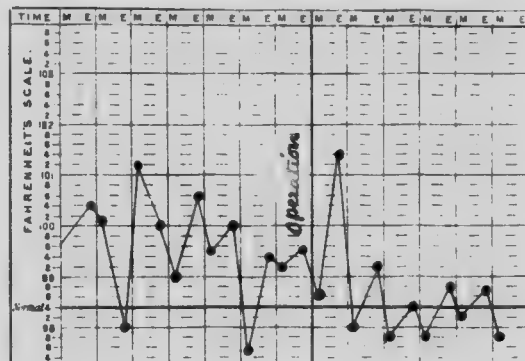


Fig. 24.—CHART.

J. I., age 67, female. Senile gangrene. Sep. Arrest of sepsis by amputation through thigh. Recovery.

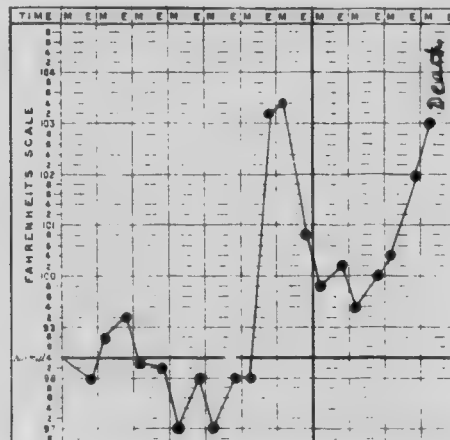


Fig. 32 -CHART.

R. R., age 53, male. Diabetic gangrene. Septic.

ERYSIPELAS.

Erysipelas is due to streptococcic infection of the skin or of a mucous membrane, through a wound, which may be very minute.

It spreads peripherally, often spasmodically. At its outer edge the lymphatics are filled with streptococci, which may also be obtained from superficial blebs.

The first symptoms are shivering, headache, general malaise, and often vomiting (*Fig. 26.*) The temperature rises; the pulse is quick; the tongue foul, and often dry; the urine scanty, and often albuminous; the gastro-intestinal functions are disturbed; and there is frequently delirium.

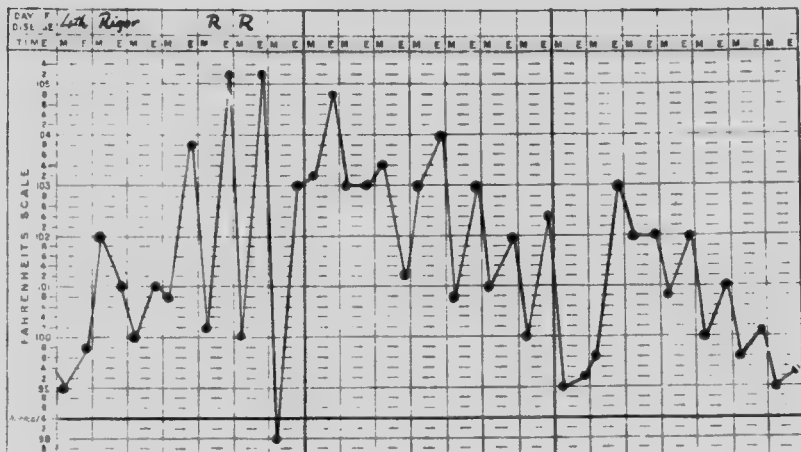


Fig. 26.—CHART.

B. L., aged 21, female. Facial erysipelas following septic scratch.

Round the infected point the skin is red, glossy, swollen, and hot; and a burning pain is present. The exudate, in addition to showing itself as swelling, often appears in serous blebs on the surface of the red area. The swollen edge, where the disease is progressing, is specially tender to the touch, and its spread may be noted by observation of the tender area. The lymphatics, when superficial, may be seen as red lines in the skin; and, when deeper, can be felt as tender cords. The glands into which the infected area drains are swollen and tender.

(It will be observed that the above description is simply that of an acute spreading inflammation of the skin with inflammatory fever. It illustrates how a special disease, in this case erysipelas, may be thought of in terms of general principles alone.)

The disease has an incubation period of from one to two days ; and a duration of from one to two weeks. Recovery is usual ; but death may result from toxæmia, meningitis, or from blood infection. Chronic œdema may also result from repeated attacks.

Varieties :—

Facial erysipelas.

Erysipelas neonatorum (around the umbilicus of newly-born babies). Always fatal.

Phlegmonous erysipelas, or cellulo-cutaneous erysipelas, or diffuse cellulitis. (Here diffuse suppuration or abscess formation is likely to occur in the infected cellular tissue.)

Angina Ludovici.—(Diffuse cellulitis occurring in the neck ; secondary to mouth infection.)

Parametritis.—Chiefly affecting the cellular tissue of the broad ligaments of the uterus, and secondary to laceration and infection of the uterine cervix.

TREATMENT.

The whole of the red area should be painted twice daily with tincture of iodine, and round this, at a distance of one inch, a ring of iodine liniment should be painted every morning. The painted surface should then be covered with cotton wool. Five grains of calomel at night, followed by a seidlitz powder in the morning, should be administered every other day, and the patient allowed to drink abundantly of water.

GONORRHŒA.

Gonorrhœa is an inflammation due to the gonococcus which primarily affects the urethra in males, the urethra and cervix uteri in females, the vulva in little girls, and the conjunctiva in infants.

Modes of Infection.—Ordinarily, by coitus ; extraordinarily, during birth (the eyes of babies) ; and by infected clothing and towels (in children).

Pathology.—Gonococci may be free in the pus, or contained in leucocytes. (See *Plate II, Fig. B.*)

They may spread *superficially*, involving the posterior urethra, urethral gland ducts, prostatic ducts, vas, epididymis, vesiculæ, ureters and kidneys, and the kidney pelvis ; or, *deeply* into the sub-mucous layer of the urethra (the cause of stricture) ; or into the corpus spongiosum (the cause of chordee).

Signs.—Three to five days after the infection, swelling, redness, a burning sensation, and heat are noticeable at the meatus. Then

follow purulent discharge, pain on micturition, swelling of the prepuce, and often chordee.

Progress.--After two to four weeks, the symptoms abate if the disease is limited to the anterior urethra.

TREATMENT.

The main object in treatment, for males, is, if possible, to limit the disease to the anterior urethra, i.e. the portion of the urethra in front of the compressor urethrae muscle. The chief indications are, rest in bed, cleanliness, and free drainage. The latter are secured by frequent antiseptic ablutions and changes of antiseptic absorbent cotton dressings. Abortive treatment, such as the use of strong injections before forty-eight hours, has been successful, but only rarely. After the acute symptoms have subsided, the careful use of antiseptic injections, especially of those containing silver, is of value. An abundant supply of fluid, as barley-water, milk and soda-water in equal parts, distilled water, pure drinking water, or other diluents to in-

crease the quantity and to diminish the irritating contents of the urine, are important aids. In the later stages, the internal administration of santal oil in steadily increasing doses up to 30 minims three times daily, if well tolerated by the stomach, may be of great service.

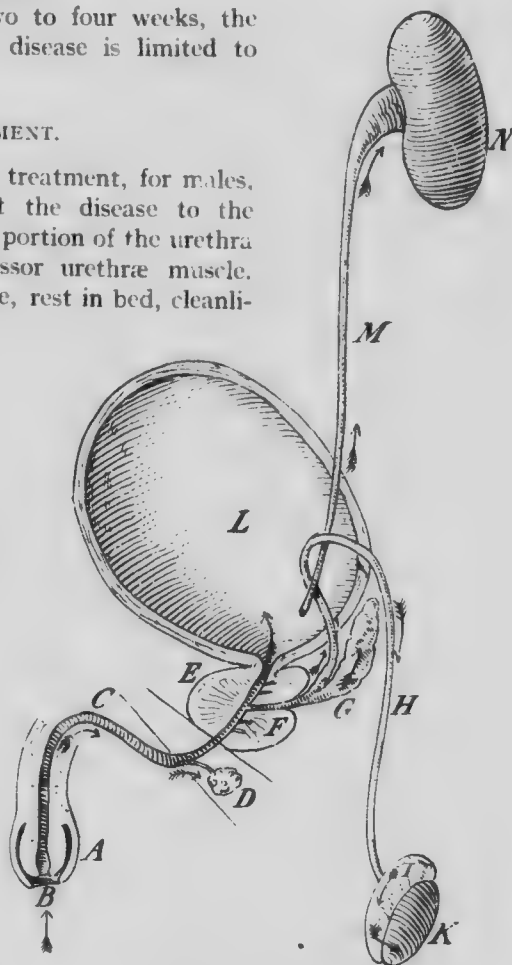


Fig. 27.—GONORRHOEAL INFECTION.

The arrows indicate the direction of superficial spread. *Deep spread*—1. Tissue of urethra. 2. Corpus spongiosum.

- | | | |
|------------------------|----------------------|---------------|
| (A) Prepuce. | (F) Prostate. | (K) Testicle. |
| (B) Glans penis. | (G) Seminal vesicle. | (L) Bladder. |
| (C) Urethra. | (H) Vas deferens. | (M) Ureter. |
| (D) Cowper's gland. | (I) Epididymis. | (N) Kidney. |
| (E) Prostatic urethra. | | |

If the inflammation has extended to the posterior urethra, as indicated by a frequent and urgent desire to micturate, recovery requires some months, and a satisfactory treatment can only be based upon the findings discoverable by skilled urethroscopic examination. The condition called **gleet** depends upon a great variety of lesions which can only be discovered by the same skilled methods, without which any treatment is unlikely to be satisfactory.

In women, the urethral infection is seldom severe or lasting, and requires nothing more than rest, cleanliness, and the internal use of diluents.

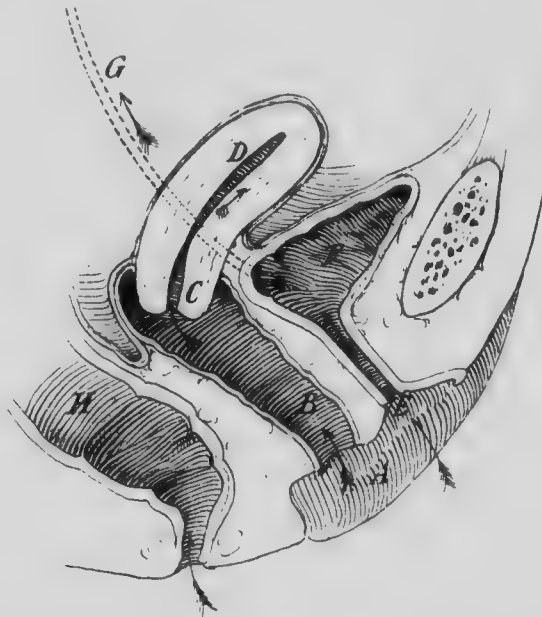


Fig. 28.—GONORRHOEAL INFECTION.

The arrows indicate the direction : (A) Vulva. (B) Vagina. (C) Cervix uteri. (D) Uterus. (E) Urethra. (F) Bladder. (G) Ureter.

A uterine cervical infection should be treated actively by the introduction of a probe carrying a solution of nitrate of silver, grs. x to the ounce, three times a week, and daily packing of the upper vagina with iodoform-formalin-gauze, till all evidence of disease has disappeared.

Complications.—These are *local* and *general*.

Local.—In men, balanitis and inflammation of prepuce, paraphimosis, infection of Cowper's glands, prostate, vesiculæ seminales, vasa deferentia, epididymis, bladder, ureters and kidneys, pelvic

peritoneum, lacunæ, and lymphatics of urethra (causing abscess or suppurating glands), and of sub-mucous tissue (causing stricture) (Fig. 27).

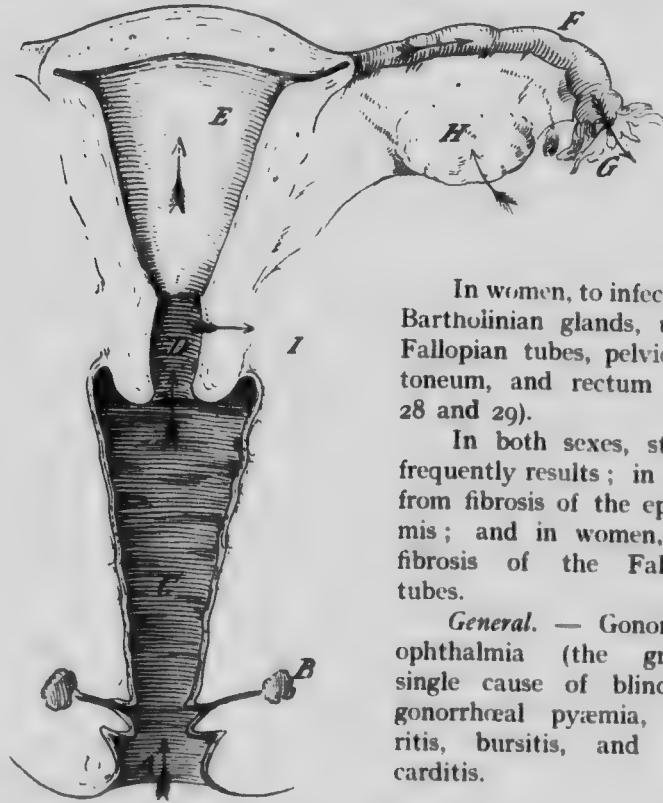


Fig. 27.—SPREAD OF GONORRHOËAL INFECTION.

The arrows show the direction: (A) Vulva. (B) Bartholin's gland. (C) Vagina. (D) Cervix. (E) Uterus. (F) Fallopian tube. (G) Opening into pelvic peritoneum. (H) Ovary. (I) Pelvic cellular tissue.

In women, to infection of Bartholinian glands, uterus, Fallopian tubes, pelvic peritoneum, and rectum (Figs. 28 and 29).

In both sexes, sterility frequently results; in males, from fibrosis of the epididymis; and in women, from fibrosis of the Fallopian tubes.

General. — Gonorrhœal ophthalmia (the greatest single cause of blindness), gonorrhœal pyæmia, arthritis, bursitis, and endocarditis.

ULCERS.

Ulcers and gangrene must be considered in connection with inflammation (Fig 30).

The cause of ulcer is a localized *defective blood circulation*, and of gangrene its *complete arrest*.

Cause.—The defective blood-supply causing ulceration is nearly always due to inflammation; consequently, ordinary ulcers (not cancerous and other special varieties) are to be regarded as the result

of infection by pyogenic microbes, or by the organisms of tubercle or syphilis.

Other conditions predispose to ulceration, and they may be either *General* or *Local*.

General Predisposing Causes are : debility, from any cause ; anæmia ; heart disease ; Bright's disease ; diabetes ; scurvy, etc.



Fig. 30.—DEBILITY (VARICOSE) ULCER.

Note the position in lower part of leg.

Local Predisposing Causes are : traumatism (especially continuous pressure) ; and diseases of arteries, veins, or nerves.

Varieties.—The following varieties of ulcer are described in text-books : simple healing ulcer ; exuberant ; œdematous ; callous ; varicose ; irritable ; perforating ; inflammatory ; sloughing ; phagedenic ; tuberculous ; venereal ; scorbutic, etc.

In making a diagnosis in cases of ulcer there are certain questions to be answered. They concern :—

The History. How did it commence?

A varicose ulcer commences frequently with an irritable patch of dermatitis, or a small abrasion. A syphilitic ulcer, as a firm nodule which "inflamed and broke." Perforating ulcer, with a corn, etc.



FIG. 31.—SYPHILITIC (GUMMATOUS) ULCERATION OF LEGS.
Note the position of ulcers in the upper part of legs.

Does anything in the Condition of the Patient suggest a cause?
e.g., Scars on the neck, or other signs of tubercle. Remains of old syphilis in the eyes, nose, mouth, throat, ears, or elsewhere. Varicose veins. Evidences of scurvy. Signs of nerve disease, such as anaesthesia, etc.

What is its Locality?

Debility ulcers choose the lower third of the leg (*Fig. 30*).

Syphilitic ulcers, localities where the blood-supply is normally least; namely, the mid-line of the body, the upper third of the leg,



FIG. 32. —TUBERCULOUS ULCERATION OF NECK.
Note the position.

the region of the deltoid, and the buttocks (*Fig. 31*). Tuberculous ulcers choose positions where the vascular supply is best, such as the face, neck (*Fig. 32*), etc.

Is there more than one Ulcer?

e.g., Multiplicity suggests tubercle or syphilis.

The Shape of the Ulcer?

A serpiginous shape, or multiple circular sores, suggest syphilis. An oval, longer vertically, suggests a varicose ulcer. A deep punched out, circular sore, a perforating ulcer (*Fig. 33*), etc.

The Character of the surrounding Skin?

Irregular, hard, puckered cicatrices, indicate burns (*Fig. 34*). Circular scars and pigmentation point to syphilis (*Fig. 35*). Depressed scars to bone (*Fig. 36*). Around varicose ulcers the skin is eczematous, dusky, and pigmented. It is hairy, thickened, and coarse in the neighbourhood of callous ulcers.



FIG. 33. —DIAGRAM OF PERFORATING ULCER.

(A) Section of corn. (B) Track. (C) Perforation of joint and septic arthritis. Painless when probed.

The Discharge ?

Small in quantity, watery, and foetid, in callous ulcer. Containing tubercle bacilli, in tuberculous ulcer. Abundant, purulent,



FIG. 14.—BURN SCAR. Showing deformity of arm.

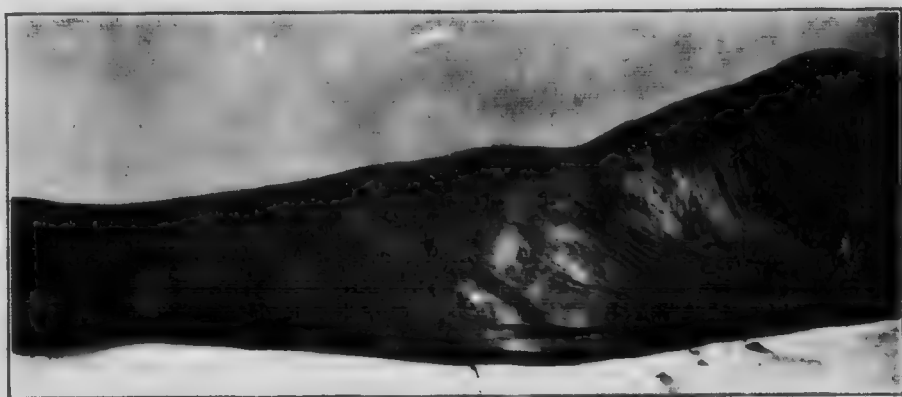


FIG. 15. SCARS OF HEALED GUMMATA OVER KNEE AND FRONT OF LEG.



Fig. 36.—A BONE SCAR. Note the depression. The scar is fixed to the rib.

and sanious, in active spreading ulcer. Thick, and foetid, in syphilitic ulcer.

The Edge ?

Thick, firm, whitish, and elevated, in callous ulcer. Undermined, thin, livid, surrounding tags, in tuberculous ulcer (Fig. 37). Undermined, thick, and purple edge, in syphilitic ulcers. Corny, in perforating ulcers.

The Base ?

Tubercular in tuberculous ulcer. "Wash-leather slough"



1. *Healing Ulcer.* (A) Normal skin, (B) Heaped-up epithelium, (C) Thin advancing margin of epithelium, (D) Granulations.



2. *Tuberculous Ulcer.* Undermined edges with perforations and tags.



3. *Gummatous Ulcer.*—Cleanly punched out, Slough on base.

FIG. 37. DIAGRAMMATIC SECTION OF ULCERS.
3A

in syphilitic ulcer. Greenish, glazed appearance in callous ulcer.

Pain ?

This may be the chief characteristic of some ulcers—irritable ulcers. Absence of pain, indeed anaesthesia, that of others, perforating ulcers (*Fig. 38*).



Fig. 38.—PERFORATING ULCER (TABES DORSALIS). Bare bone was discovered with a probe at the bottom of the ulcer. The introduction of the probe was not felt by the patient.

Is the Ulcer extending, healing, or neither ?

An extending ulcer is attended by the signs of inflammation. A healing ulcer is painless ; it discharges but little ; the surrounding skin is healthy ; the edge is shelving ; and there are from without inwards, white, blue, and red circles of new epithelium extending on to the sore (*Fig. 39*), the base of which is covered with small red granulations to the level of the surrounding skin. It is decreasing in size.

TREATMENT.

The Principles of Treatment are simple : they comprise an endeavour to remove the predisposing and exciting causes.

Where much skin has been destroyed it may be needful to assist the efforts of nature by skin-grafting.

The treatment of ulcers is (1) *General*, and (2) *Local*.

1. **General Treatment** is mainly the same as that of inflammation, namely, rest. For tuberculous and syphilitic ulcers, the constitutional treatment necessary for each has to be added. The treatment of tuberculosis comprises an endeavour to bring about an improvement in the resisting power of the patient. The most generally useful of antisyphilitic remedies is to be found in a

combination of potassium iodide and bichloride of mercury (potass. iodid. gr. xv, hydrarg. perchlor. gr. $\frac{1}{16}$, dissolved in a wineglassful of water, and taken three times a day).

2. The Local Treatment aims at :—

- a. The position of rest which most aids the local circulation.
- b. The application of moist heat.
- c. The abolition of sepsis.
- d. A dressing which will not interfere with wound healing.

For ulcers of the lower extremities, rest in bed is specially indicated, as a first step. It is not essential to keep the legs still after

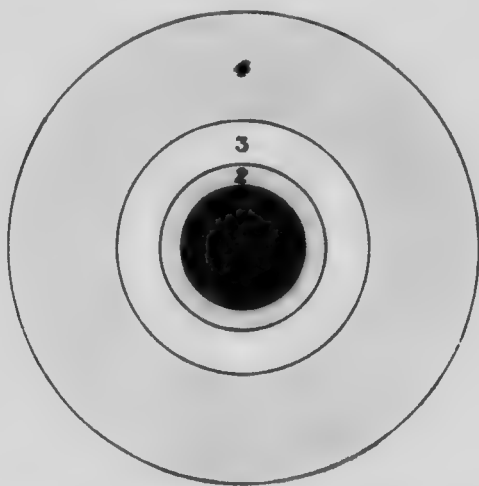


FIG. 30. DIAGRAM OF SURFACE OF HEALING ULCER.

(1) Red granulating area. (2) Bluish area—thin layer of epithelium. (3) White area—sodden epithelium. (4) Normal skin.

active mischief has subsided. They should indeed, whilst lying, be exercised regularly three times a day—as in pedalling a bicycle—in order to stimulate the circulation.

For the first dressing of inflamed ulcers a large hot bread poultice, made of old bread-crumbs and boracic acid lotion (5j to the pint), renewed every six hours, cannot be beaten. The poultice should be covered with an abundant layer of cotton wool, and its heat maintained by hot bottles, or substitutes for them.

In a few days (when improvement has commenced), and at once with chronic ulcers, a careful attempt should be made to disinfect the ulcer and surrounding skin by prolonged washing (for not less

than a quarter of an hour) with carbolic lotion, of strength 5 per cent. After this, the following dressing should be applied : next the ulcer a portion of green protective, large enough to entirely cover the sore, but no more. The protective must first be disinfected in corrosive sublimate lotion, 1 in 1000, which, previous to its application, is washed off in warm boracic lotion. Over the protective, a large thick pad of sterile gauze, wrung out of hot boracic lotion. Over the gauze, a thick sprinkling of sterile boracic acid powder, and abundance of heated cotton wool (gamgee tissue is most convenient). The whole dressing is then retained with a bandage, and heat maintained, as before, by hot bottles. It is unnecessary, and hurtful, to disturb this dressing frequently. If there is no discomfort, no discharge, no bad odour, and no rise in temperature, it should be left in position for a week. The same dressing, with a starch or plaster-of-Paris bandage, is most useful for patients who are obliged to go about during treatment.

When all these conditions cannot be fulfilled, the best substitute is Martin's indiarubber bandage. It is a pity that a device so excellent should be so little employed. Few leg ulcers will not heal under it, and many people with large ulcers suffer needless pain and disability for the want of it. It should be put on in the morning, before getting out of bed, with no reverses, and with just sufficient firmness to hold on, and it should be worn all day. There should be no tight feeling or discomfort in the leg or foot on getting up. Over the bandage, a long, thick, well-fitting woollen stocking should be carefully drawn. At night, after getting into bed, the bandage is taken off. The leg and ulcer are thoroughly washed with soap and hot water, and the ulcer is covered with a piece of green protective, wrung out of hot boracic lotion, and with boracic lint similarly treated. The leg is then bandaged in cotton-wool for the night. All this dressing is taken off in the morning; and after the leg has been well rubbed, the bandage is re-applied to the bare skin and ulcer. The indiarubber bandage should be thoroughly washed with soap and hot water every night, and hung up to dry till morning.

The patient must be warned that "boils" may develop under the bandage, but that they must be allowed to constitute no objection to its continued use. He should also be cautioned that the bandage will be ruined by the application of any grease.

Treatment of Special Ulcers.—The healing of callous ulcers may be expedited by painting liquor epispasticus over the ulcer and the surrounding skin, previous to the application of the poultice.

Tuberculous ulcers should be excised when feasible, otherwise they should be curetted, cauterized with pure carbolic acid, and dressed

with iodoform. Syphilitic ulcers may be stimulated by a black-wash dressing, or their healing may be hastened by the surgical removal of pieces of dead tissue.

Ideal Treatment.—If the ulcer is not too large; if the condition of the surrounding tissues is satisfactory; and if the patient's health be favourable, excision of the ulcer, followed by the application of



Fig. 40. -CANCNUM ORIS. Acute localized infective gangrene.

a graft of the entire skin to the wound resulting, is the most satisfactory of all forms of treatment. Skin-grafting on a more moderate scale is occasionally useful.

Acute Infective Localized Gangrene.—Occupying a place midway between ulceration and gangrene, there are a variety of conditions—phagedæna, noma (*Fig. 40*), facial carbuncle, etc.—due to bacterial

infection of so virulent a character, that the inflammation they set up in the tissues attacked, ends in local death, and absorption of their virulent toxins not infrequently kills the patient. The signs in all are the same. They are those of an inflammatory swelling, so vicious in its progress, that indications of local gangrene are obvious before many hours have passed. The treatment for all these conditions is to remove the entire focus of infection as soon as this can possibly be done.

The difference between an ordinary and an infective gangrene cannot be observed to better advantage than on the penis. Acute balanitis and a tight prepuce may cause sloughing of the entire prepuce, from the tension arising from inflammation and pent-up secretion. The whole prepuce may die; *but*, the gangrene is marked off by a line surrounding the glans penis, and is limited accordingly. On the other hand, acute infective gangrene (*phagedæna*) causes sloughing, generally localized, of the prepuce; but spreads quickly to involve the skin covering the penis, the scrotum, and the abdominal wall.

Death of any part of the tissues will follow arrest of its blood circulation (this is *the* cause of gangrene). In the soft tissues, a dead portion is called a slough, the term gangrene being generally understood as referring to the death of an extremity, or of a large part of it.

GANGRENE.

A rare form of gangrene is due to infection with virulent bacteria; and in its rapid course, and frequently fatal termination, resembles the localized infective gangrenes previously mentioned. In such a case following a wound, possibly one so trivial as a prick, the signs of a violent, progressive inflammation are evident. The whole extremity is swollen in a few hours; the red blush of inflammation changes to a purple hue; the purple becomes patchy, and the intervening skin like mottled glazed tallow. Blebs form on the surface; crackling of putrefactive gases in the interior may be felt by pressing on the skin; and the patient dies before the fourth day has passed. In some of these cases, a specific bacillus—the bacillus of malignant œdema—has been found. It has also been obtained from the well-manured soil of gardens. The only useful treatment—though recovery has seldom followed—is high amputation, special precautions being taken to prevent reinfection of the wound by the infected part during its removal.

CASE 2.—The only case of recovery I can recall is that of a boy, aged 8, who was admitted to the Royal Infirmary on May 27, 1892.

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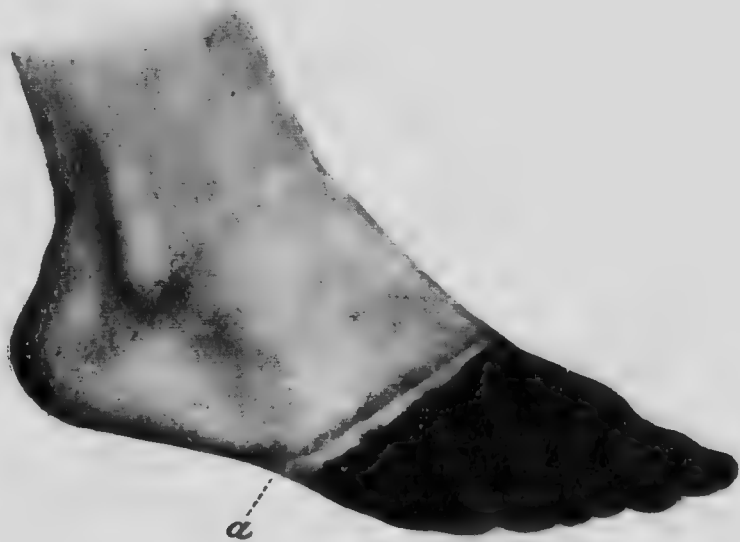
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PLATE V.



GANGRENE.

" The line of demarcation

He was admitted for a compound fracture of the radius and ulna from being run over. Mr. Wardale, then house surgeon, cleansed the limb; and everything appeared to be going well till the evening of June 3d. On June 4th, I saw the boy. His arm was swollen up to the shoulder; there was a considerable area of gangrenous skin round the wound in the forearm; crepitation could be felt under the swollen skin; and the general condition was very grave. I at once amputated the arm at the shoulder-joint; left the wound quite open; and packed its cavity with lint soaked in tincture of iodine.

Next morning, the boy's condition was still very grave; and crepitations could be felt under the skin covering the chest as far as the sternum, and over the back and scapula as far as the spine. It was obvious that the gangrenous process had extended to the underlying parts. I shall never forget the ward sister's reproachful look, as if it was a cruel request, when asked that the boy should again "be sent to the theatre at once." I then proceeded to remove as much of the skin of the chest and back as I dare. The underlying parts were crackling with gas, and of a dirty green colour. After excising the pectoral muscles, the scapula, and the muscles connected with it, I again packed the open wound with strips of lint soaked in tincture of iodine.

From this time the gangrenous process was arrested, and the boy recovered.

The usual forms of gangrene depend upon **arrest of the circulation by more ordinary conditions, and they have not the active spreading qualities of the infective gangrene described**

CAUSES.

The causes are—(1) *Predisposing* and (2) *Exciting*.

1. **Predisposing Causes** are: debility from any cause; old heart disease; diabetes; Bright's disease; and certain disturbances of the nervous system (Raynaud's disease).

Exciting Causes are: crushes, burns, and scalds; frost-bites; prolonged pressure; injury, or ligature, or dissections of the blood-vessels. It is well known—sometimes not sufficiently remembered—that a bandage too tightly applied will produce gangrene. If a not too fat limb were chosen, emptied of its venous blood by compression and elastic bandaging from the toes, and a tourniquet were applied above, sufficiently tight to arrest all circulation: the limb below the tourniquet would become, first pale and swollen, then tallowy, then brown, and finally black, dry, and mummified, until it dropped off—dry gangrene. (Plate V.)

If a bandage were applied tightly to a similar limb, but only sufficiently so to arrest the venous and not the arterial circulation, it

would become swollen and purple below, then mottled, then red, purple and green; blebs would develop on the skin, which, on separating, would leave a slimy, soft, stinking, gangrenous mass—moist gangrene.

The clinical differences are specially marked, and are emphasized in all books; the danger and the constitutional disturbance associated with the moist variety receiving special notice. This is attributed to infection by organisms, and quite rightly; but it should also be pointed out, that this infection is *secondary*, and an avoidable complication. If the skin of the gangrenous extremity had been made surgically clean, and a suitable antiseptic dressing had been applied, it would then have been made possible for the fluids to escape and dry up, and for the limb, affected with moist, to assume the condition of dry, gangrene. The constitutional disturbance usually associated with moist gangrene would not then show itself, since it is due to the growth of organisms in the gangrenous tissue, organisms which have effected an entrance through the damaged skin. This explains the difference between the bed-sore of a good and of a bad nurse. A bed-sore may be unavoidable; but the good nurse, by careful preparation of her patient's skin, limits the mischief to the part pressed upon, while the poor nurse's patient develops inflammation from dirt and infection, and has a rapidly spreading sore.

Emboli (*Thomson and Miles' Text-book*).

"The **Abdominal Aorta** may become suddenly occluded at its bifurcation by an embolus, the obstruction of the iliacs and femorals inducing symmetrical gangrene of both extremities as high as Poupart's ligament (*Fig. 41*). When gangrene follows occlusion of the **external iliac**, or of the **common femoral artery**, the death of the limb extends as high as the middle or upper third of the thigh (*Fig. 42*). When the **superficial femoral** or **popliteal** artery is obstructed, the veins remaining pervious, the anastomosis through the profunda is sufficient to maintain the vascular supply, and gangrene does not necessarily follow. The rupture of a popliteal aneurysm, however, by compressing the vein and the articular vessels, usually determines gangrene. When an embolus becomes impacted at the **bifurcation of the popliteal**, the gangrene which ensues usually spreads well up the leg (*Fig. 43*). When the **axillary artery** is the seat of embolic infection, and gangrene ensues, the process usually reaches the middle of the upper arm (*Fig. 44*). Gangrene following blocking of the **brachial** at its bifurcation, usually extends as far as the junction of the middle and lower thirds of the forearm" (*Fig. 42*).

Every gangrene is due to arrested circulation.

In infective gangrene, inflammation is the cause of the arrest, and the distinguishing character is its tendency to spread independently of the chief vascular supply.

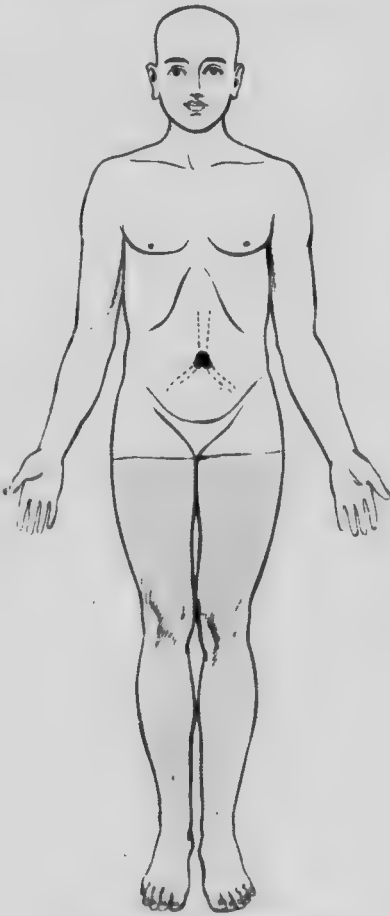


FIG. 41. —EMBOLISM AT BIFURCATION OF ABDOMINAL AORTA.

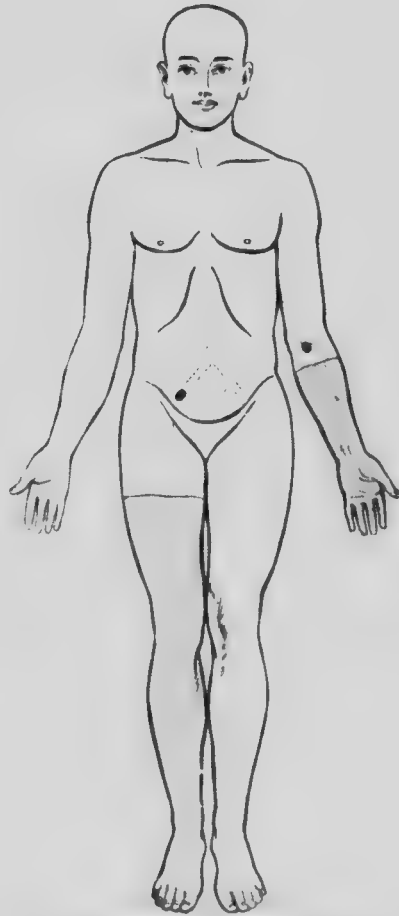


FIG. 42. EMBOLISM OF EXTERNAL ILIAC (OR COMMON FEMORAL) AND AT BRACHIAL ARTERY AT BEND OF ELBOW.

There is no such thing as a genuine dry gangrene. Every ordinary gangrene is originally moist. Whether it becomes dry; not dangerous to life; and not spreading, or the reverse, depends upon whether it can be kept free from organismal infection, or "goes septic." Dry is an aseptic, and moist a septic, gangrene.

The Line of Demarcation.—At the junction of the living tissue with the gangrenous area, a line of inflammatory reaction commences. (*Plate V.*) Along this line, granulations form from the living part, and by phagocytic action, the dead area in contact with the granu-

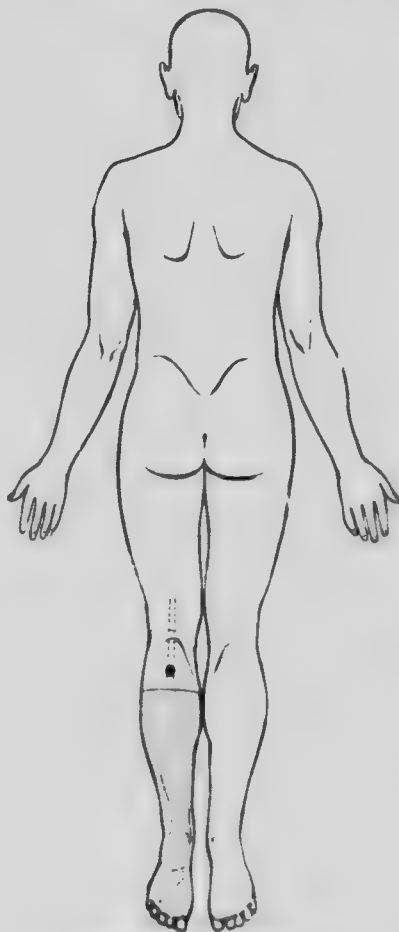


FIG. 43.—EMBOLISM AT BIFURCATION OF POPLITEAL ARTERY.

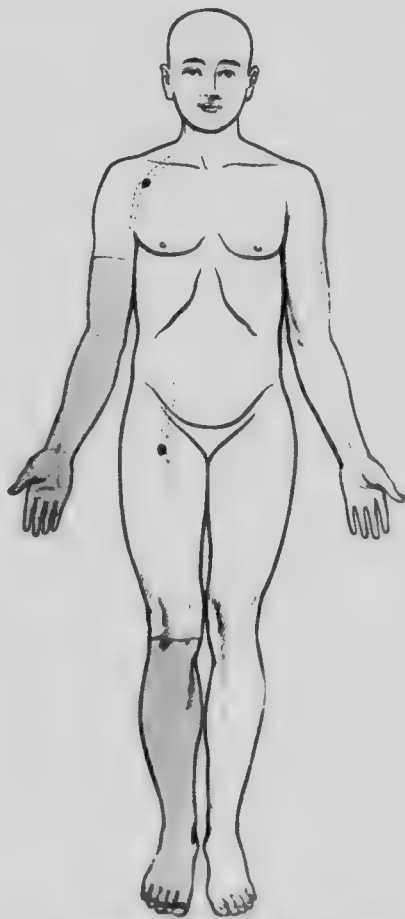


FIG. 44.—EMBOLISM OF AXILLARY, AND OF SUPERFICIAL FEMORAL (OR POPLITEAL) ARTERIES.

lating surface is eaten away. First, the skin separates; then the deeper parts, muscles, vessels, and nerves; finally, the bone. Division of the bone especially requires a long time; the process occupies many weeks, and the dangers of septic infection of the wound, and septic absorption from it, are considerable. The end

result of such unaided amputation is not good, for the skin dies sooner, retracts higher than do the muscles, and the muscles higher than the bone, exactly reversing the results of a satisfactory amputation operation (*Fig. 45*). If healing is possible, a conical stump ensues.



Fig. 45.—DIAGRAM ILLUSTRATING A SURGICAL AND GANGRENOUS AMPUTATION.
1. Surgical amputation. 2. Natural amputation, after separation of gangrenous part.
(A) Skin. (B) Muscle. (C) Bone.

The symptoms and signs of gangrene, when the process is complete, are so plain that no one can mistake them. It is when



Fig. 46.—DIABETIC GANGRENE.
Superficial, and starting on the dorsum of the foot; not in the toes.

gangrene is *threatening* that the diagnosis is important, and it is then that it is most difficult. It is usual for patients to have premonitory symptoms, because, in the majority of cases, gangrene is only an end result; the circulation has been interfered with long before its total arrest. (Usually thrombosis in the diseased vessel determines the gangrene.)

In senile gangrene—that clinical variety due to atheroma of the vessels—the patient suffers from alterations in sensation of the foot and leg. It may be a feeling of constant coldness, or of burning heat, so severe as to drive him to sleep with the affected foot out of bed; or one of tingling combined with pain and numbness. The first indications of gangrene are likely to be seen at the end of a toe.

In diabetic gangrene, cramps in the calf of the leg, so bad as to make the patient shout and faint, have often preceded local signs. A patch or patches of gangrene on the sole or other parts of the foot (*Fig. 46*), *not the toe ends*, suggest diabetes as a cause.

In Raynaud's disease, many threatening attacks, lasting from a few minutes to hours, have come and gone before gangrene supervenes, and such attacks have often been followed by hæmoglobinuria.

The condition of the circulation can be tested in three ways:

1. By examination of the main arteries as to the state of their walls (thickening, induration, or *x-rays*, *Fig. 47*), and the strength of their pulsation.

2. By testing the capillary circulation. The rough test, usually employed, is to press all blood out of the skin, and watch the rapidity of its return.

3. By the production of artificial hyperæmia. If, after elevating the limbs to empty them of blood, an elastic bandage is applied as a tourniquet to each, left on for a few minutes, and then taken off, the normal limb will quickly flush down to the toes, the abnormal one only to that position where the circulation is active. (This test may be employed as an aid in the determination of the amputation site.)

TREATMENT.

When gangrene is threatened, something may be done to arrest it; when it has developed, the worst consequences arising from it may be averted. In every case, it is essential to make the skin surgically clean as soon as the possibility of gangrene is suspected. This can be done by thorough washing with soap and hot water,

followed by careful sponging with 1-1000 corrosive sublimate and spirit lotion, dusting with boracic powder, and an abundant wool dressing. Between fingers and toes, strips of dry boracic lint should be laid, to keep the skin between them separated and dry. The



Fig. 47. X-RAY OF LEG FROM A CASE OF SENILE GANGRENE.
Note the calcareous arteries.

limb should be placed in a slightly elevated position to favour the return of venous blood, and for the same purpose it should be rubbed upwards, from above the dressing, for a few minutes several times

GANGRENE

daily. Hot-water bottles, when used with care, are useful aids. When gangrene threatens the foot and leg, as it usually does, the patient must stay in bed, and not be allowed to hang the leg down for any purpose whatever. A dose of opium, sufficient to secure



Fig. 48.—GANGRENE OF LEFT LEG.
Due to embolism in popliteal artery. (See Temperature chart.)

relief from pain and afford rest, should not be withheld, and ought to be given every night, if required. Nutritious food, and aperients, or a daily enema, complete the general directions.

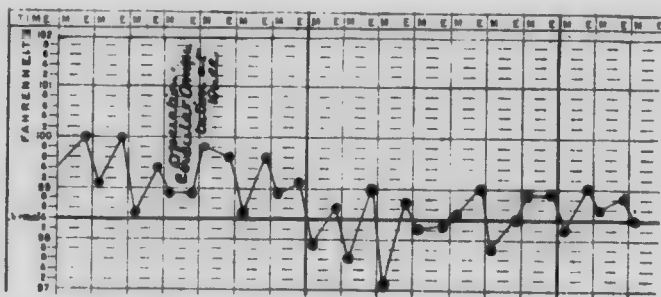


FIG. 49.—CHART.

S. E. L., age 29, female. Gangrene. Embolism of popliteal artery and thrombosis of all veins 14 days after parturition.

When gangrene has developed, if the gangrenous part can be kept dry, two courses are open: to leave the separation to nature, or to amputate (*Figs. 48 and 49*). (Traumatic gangrene, including burns, scalds, etc., only demands amputation above the injured part.)

Gangrene from Frostbite.—The ordinary preventive treatment requires modification in the case of frostbite with threatened gangrene. The most successful practice appears to be, first to rub the affected part with snow in a cold room, and only by degrees to allow the patient to go into a warmer atmosphere and use warmer clothing. If gangrene occurs, the extremity should be kept aseptic, and watched till the limit of the gangrene is clearly seen. Amputation can be performed immediately above this.

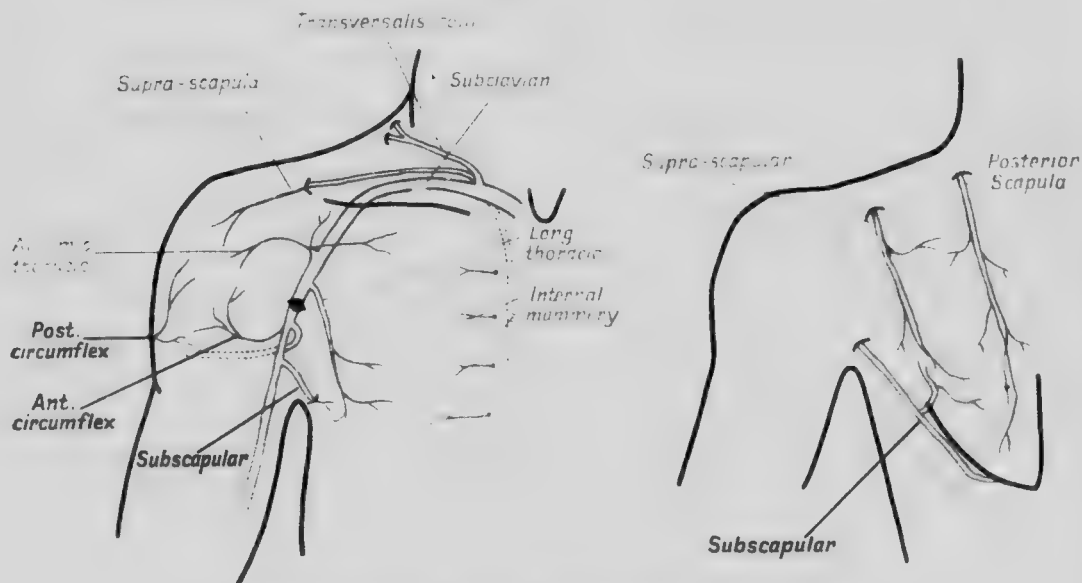


Fig. 50.—ANASTOMOSES AFTER LIGATURE OF THE THIRD PART OF AXILLARY ARTERY.

Gangrene following Ligation of Arteries or Embolism.—The application of a ligature to any vessel (Figs. 50 and 51) large enough to make gangrene a possibility (Figs. 41-44), demands that the skin of the extremity should be made surgically clean, in the manner previously described, and no careful surgeon would, except in emergency, so operate in the presence of a septic area in the part below. The quotation, previously offered (page 44), suggests the average result of ligation or embolism of the large arteries when gangrene follows; but so much depends on the many factors concerned in the blood circulation, that it is impossible to make any definite rule as to amputation, except that it may turn out to be false economy to try to save too much. Probably the hyperæmia test offers the most satisfactory measurement, for it would be safe to amputate where this showed the blood circulation to be active.

GANGRENE

Senile Gangrene.—Obstinate sores in connection with injuries or corns, or ingrowing toe-nails, when the patients are elderly, require the greatest attention, as they often form the starting-point of senile gangrene. If the gangrene is limited to a toe or toes, it is my practice to advise waiting, and careful dressing. The slightest operative assistance to separation of the gangrenous part must be long delayed, and a useful rule is to do as little as possible. So soon

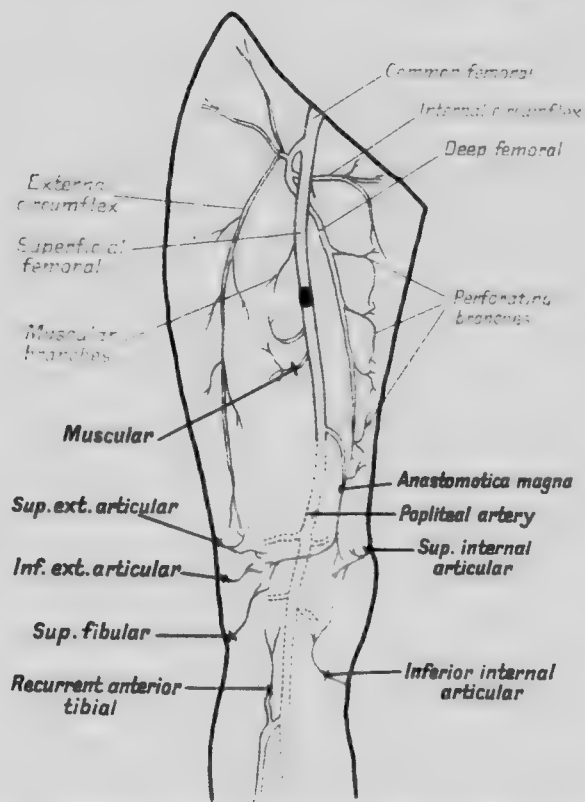


Fig. 51.—ANASTOMOSIS AFTER LIGATION OF THE SUPERFICIAL FEMORAL ARTERY.

as gangrene has extended on to the foot, nothing is to be gained by waiting, and the patient's condition deteriorates from pain, from loss of rest, exercise, and appetite, whilst the dangers of septic infection are very real. My rule, then, is to advise amputation at or above the knee.

Diabetic Gangrene.—The prognosis here is worse than in senile gangrene; but early amputation above the knee, along with proper

SYPHILIS, TUBERCLE, MALIGNANT DISEASE 53

attention to the general condition, is followed by recovery in the majority of cases.

The best form of amputation to employ in these cases is one on the principle of the old circular method. This entails less interference with the circulation in the stump than any other.

SYPHILIS, TUBERCLE, AND MALIGNANT DISEASE.

Three of the most common surgical diseases, tubercle, syphilis, and malignant disease, resemble each other in so many respects that it will be helpful to consider them together, before entering on the details of each separately.

For two of them—syphilis and tubercle—the responsible organism has been discovered. It is still being searched for in respect to cancer and sarcoma.

All of these diseases commence locally, and spread mainly by the lymphatics.

The primary lesion in each may either take the form of a tumour, or that of an ulcer. Thus, in cancer of the tongue, ulcer is common while tumour is rare; in the breast, ulcer is rare (Paget's nipple), while tumour is common.

In tubercle, the primary lesion is frequently so trifling as to pass unobserved.

In syphilis, it may be so insignificant as to attract no attention.

In malignant disease, it is usually a most important feature.

The skin and genito-urinary organs are the favourite sites in all.

Syphilis remains localized for so short a time that the generalized manifestations of it have rarely, if ever, been prevented by the earliest excision of the primary lesion. In malignant disease early excision of the primary lesion alone offers a chance. In tubercle it does not often fail.

The importance of the primary focus in all these diseases is not yet sufficiently recognized. If the primary focus in cancer is removed, secondary growths will, in a certain percentage of cases, disappear. This has occurred in chorion epithelioma, when, after hysterectomy, a secondary growth in the lung gave no further trouble. It is also proved by the occasionally successful results of old-fashioned operations for cancer, in which only the primary growth was excised, for it is now accepted knowledge that, in the great majority of these cases, the nearest lymphatic glands are early infected.

All of them infect and cause enlargement of the lymphatic glands. These seem to offer little or no resistance to the diffusion of syphilis;

considerable resistance to the dissemination of tubercle ; and, for a long time, they stop the advance of malignant disease. Therefore, syphilis is always disseminated, tubercle frequently, malignant disease rarely.

The glandular enlargement in syphilis is general ; in tubercle

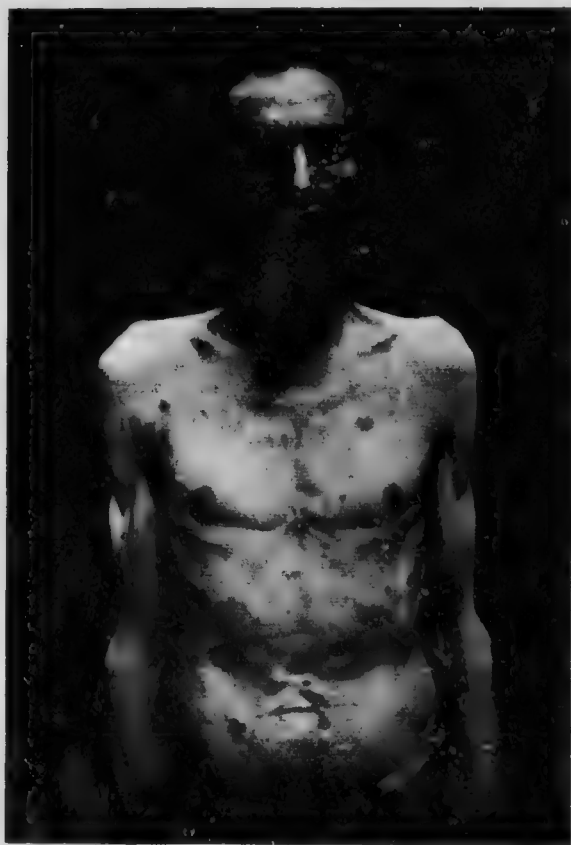


FIG. 54. PATIENT WITH PRIMARY CANCER OF THE PANCREAS AND SECONDARY GROWTHS DOTTED OVER THE BODY IN THE SKIN.

limited ; and in malignant disease localized. Following syphilitic infection, all the local glands swell and feel like almonds. Shortly after, all the glands in the body participate. Syphilitic glands never suppurate. Following tuberculous infection, the local lymphatic glands swell, one at a time, feel like a string of small potatoes, tend

to form large tumours, and frequently suppurate. Following cancerous infection, the local glands enlarge (those nearest the point of infection first), they grow into hard fixed tumours, and seldom suppurate except in the neck.

Dissemination always occurs before three months in syphilis.



Fig. 53. —BACK VIEW OF THE SAME PATIENT AS FIG. 52.

and on the skin it appears usually as a roseolous eruption. The dissemination of tubercle is rare, and occurs chiefly in the viscera of the head, chest, and abdomen. General dissemination of cancer is rarer still. When it occurs in the skin all over the body, the eruption, on superficial examination, may be mistaken for that of syphilis (*Figs. 52 and 53*). On the other hand, dissemination of

sarcoma is to be expected; and when it attacks the lungs and pleura, the symptoms and signs of tuberculous disease are closely simulated.

In each, many of the conditions described as characteristic of the disease are the result of septic infection of the primary focus. This may be a serious complication in all of them.

Syphilis confers complete immunity; tubercle partial immunity; malignant disease, probably no immunity at all

Ulcer.—It is generally possible to offer a correct diagnosis as to whether an ulcer is due to tubercle, or to cancer, or to syphilis. The age, appearance, and sex of the patient; the history of how the condition commenced, and its site; are of an importance next to the physical signs.

Tubercle is most common in the young; syphilis in the middle-aged; and cancer in the old.

Tuberculous subjects look thin and anæmic, or fat and pasty (delicate); the syphilitic look "dry," with a muddy anæmia; and the cancerous, florid and robust.

Tubercle and cancer affect both sexes equally; syphilis mainly the male.

A tuberculous ulcer usually commences as a small sore, which has gradually destroyed its site (destruction in excess of growth); the cancerous ulcer, as an irritable crack around which a tumour has developed (growth in excess of destruction); the syphilitic ulcer, as a tumour which has broken down (an ulcerating tumour).

Tubercle and cancer choose sites furnished with the best vascular supply; syphilis with the worst.

Mistakes will become less frequent with improved diagnosis; but are sometimes, as yet, unavoidable. The following are examples:—

Ulcers.—I have excised an ulcer of the lower lip, and along with it the enlarged submaxillary and submental glands of an elderly man, for "epithelioma." Microscopical examination of the growth and of the glands proved tubercle.

I excised the tongue of a stout, florid man, between 50 and 60, for an "epithelioma," which proved to be tubercle. He was quite well ten years later.

I excised the uterus of a patient for "carcinoma of the cervix." This was also a case of tuberculous disease.

Most students have seen, or will see in the infirmary clinics, chancres of the lip or tongue sent in as "epitheliomata." I treated one girl of 26 and a man of 28 with mercury and iodide, for a "chancre of the lip." They both died of cancer of the lip and neck respectively within one year.

I have observed cases of "cancer of the cervix uteri" cured by a course of iodide and mercury. They were syphilitic sores, and either had, or developed later, signs typical of syphilis.

A large number of "cancers" of the face have been cured by mercury and iodide; and as large a number of cancers of the tongue and of the penis have had their chance of cure lost through delay in operating whilst the same means were being "fairly tried."

Tumours.—The chronic inflammatory swellings produced by tubercle and syphilis have not infrequently been mistaken for malignant disease, and vice versa.

Many bowel "tumours," due to tubercle, especially of the cæcum, have been excised under the belief that they were malignant.

I operated on a case of "cancer of the pylorus," and found the disease too far advanced for anything but the palliative operation of gastro-enterostomy. To confirm the diagnosis, I removed a gland. It only contained tubercle. The microscopical diagnosis was confirmed by the permanent recovery of the patient, and the disappearance of the tumour.

A middle-aged woman had "cancer of the liver and ascites, with hard lumps in the omentum, and jaundice." Examination revealed typical tertiary syphilitic ulceration over the left shoulder. Mercury and iodide cured her.

A man, aged 38, had three attacks of acute intestinal obstruction in eighteen months. After the last of these I opened his abdomen, and found a "fixed inoperable malignant growth" in his sigmoid flexure. His doctor, who was present at the operation, mentioned that he had treated him for syphilis seven years before. Since a mercurial course he has had no further attack, and fifteen years after is well. Fortunately, I refrained from making a permanent colostomy opening, because I thought it would be soon enough for that when the obstruction recurred.

A middle-aged man had an "aneurysm of the thoracic aorta eroding his sternum." The "aneurysm" disappeared after six weeks of mercury and iodide.

I excised a large thyroid for "malignant growth" from a woman of middle-age. The microscope revealed tubercle.

In another case, I made a diagnosis of malignant thyroid, and offered a hopeless prognosis. Six months afterwards an abscess opened, and the pus was tuberculous. The patient was alive three years later.

A stout, healthy-looking lady was operated upon by one of my colleagues at my request for a "typical scirrhus of the breast." A macroscopic section confirmed our diagnosis. The pathologist

and ourselves required more than one series of microscopic sections to satisfy us that we were all wrong. The "tumour" was tubercle.

A "tumour" of a bone may be due to either.

I once saw a leg amputated at the hip-joint for "sarcoma" at the lower end of the femur. This was a syphilitic gumma.

A patient had his leg amputated at the upper part of the thigh for a "sarcoma" of the lower end. Sixteen months later a "secondary growth" appeared in the upper end of the humerus of the opposite side. This was cured with iodide and mercury, and the patient is alive and well fifteen years later.

A patient was advised amputation at the hip for a "sarcoma" of the upper end of the femur. The advice was not accepted. Twelve months later a tuberculous abscess was opened, and recovery followed.

A patient was operated on for "tubercle" of the upper end of the humerus. Profuse hæmorrhage followed the incision, and a fungating malignant growth appeared through it a few days later.

Even a skilled pathologist with his microscope may make mistakes.

A man aged 35 had his right testicle removed for a "round-celled sarcoma." Nine months later he "developed a secondary growth in his brain." This serious brain lesion disappeared after a course of mercury and iodide; nearly twenty years later he is well.

I was once asked to look down a microscope and offer a diagnosis. I felt no doubt that the section of skin revealed bore a typical epithelioma. It was a nodule of leprosy, and a favourite "catch."

A young married man had his left testicle excised for "tubercle." The diagnosis was confirmed by the microscope (no tubercle bacilli were found). One year later, his right testicle swelled as the other had done, and he resented the proposal that it also should be removed. Mercury and iodide quickly cured him.

Hodgkin's Disease (Lymphadenoma).—A condition as yet ill-understood; sometimes resembles tubercle, sometimes sarcoma, in its clinical course.

The enlarged glands, which are characteristic of it, may remain for long unchanged, then slowly soften, redden on the surface, break down, discharge a curdy matter, and finally heal. The patient with this form of the disease may live for several years. In the second type, the glands become glued together and fixed; internal deposits form quickly, and the patient dies, with dissemination throughout the viscera.

Fibrosis.—Natural cure occurs in all of these diseases. It is the rule in syphilis; the exception in tubercle; and very rare in

cancer. In all of them, the cure of the local lesions is the result of fibrosis.

The tendency to break down is characteristic of the acute type of tubercle, syphilis, and malignant disease; and to fibrose is characteristic of the chronic variety.

The natural tendency of fibrous tissue to contraction accounts for the fact that stricture of the tubular viscera may be the result of tubercle, of syphilis, or of cancer.

In all, the newly-developed fibrous tissue may grow so luxuriantly as to form a tumour, chiefly fibromatous. Keloid of the skin, and many internal growths, are of this nature; and in each of them the chief clinical characteristics are slow development and long duration, with periods of quiescence (fibrosis or sclerosis in excess), and exacerbation (infection in excess).

In the prognosis of cases of cancer everything depends upon the amount of existing fibrosis. The ill-defined diffuse growths, so active as to simulate inflammatory swellings, offer the worst prognosis. The firmer, more defined growths, resembling simple tumours in their physical characteristics, are the most favourable in prognosis.

A growth, rich in cells, and without much fibrous tissue, will rapidly disseminate and kill.

I have known a patient die of breast cancer within three months of its appearance. On the other hand, one patient under my care lived for twenty-five years after two operations for breast cancer, both of which failed to remove the growth, and were followed by an inoperable recurrence. Death resulted from extension of the cancer to the pleura and lung. From time to time I had the opportunity of watching the great fight between cancer and fibrosis; and though complete healing never occurred, the supremacy of the external fibrous tissue was maintained till the end. This was at the expense of much discomfort to the patient, for the right side of her chest was tightly bound and contracted by thick large patches of scar tissue.

Many cases of atrophic scirrhus cancer of the breast have lived for years without much discomfort; and have frequently, in the end, died through bone infection. They owe their benign course to fibrous tissue formation. Some of them assume a more malignant course after operation, and in view of what has been said, the explanation is obvious.

Cancer of the colon may be one of the most malignant, or one of the most benign of malignant growths.

If it takes the form of a tumouring ulcer, without stricture,

its course is malignant (*Fig. 54*); if, on the other hand, stricture (i.e. fibrosis) is the predominating feature, a better prognosis can be offered (*Fig. 55*).

Tuberculous glandular tumours of long-standing are chiefly composed of fibrous tissue.

A patient of mine carried about a testicle the size of a cocoanut for twenty years, before it troubled him sufficiently to require removal. It was syphilitic, but consisted chiefly of fibrous tissue.

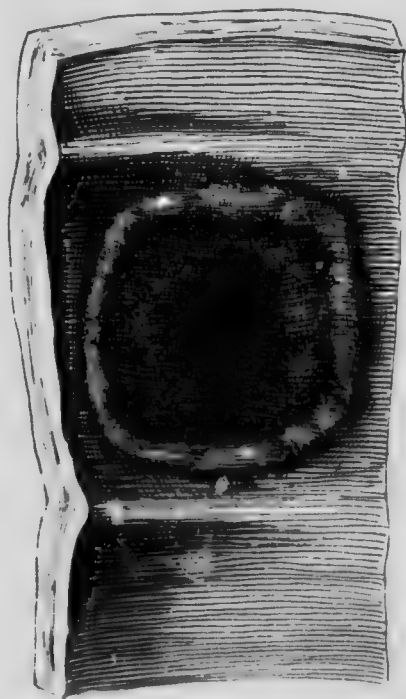


Fig. 54.—LARGE ULCERATING CARCINOMA OF LARGE INTESTINE.

Malignant variety, with little obstruction and little fibrosis.

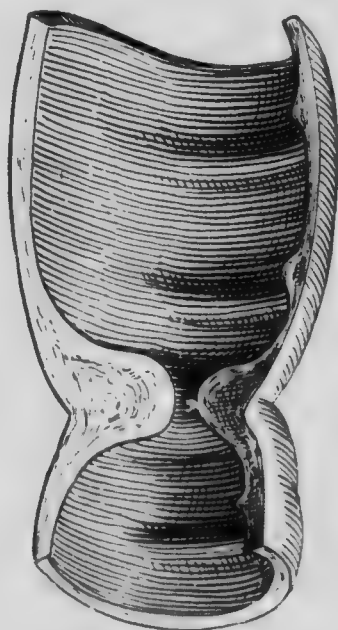


Fig. 55.—CONSTRICTING CARCINOMA OF LARGE INTESTINE.

Chief signs, intestinal obstruction and marked fibrosis.

Bones.—For bone sarcomata, the rule corresponds exactly with that discussed above. Their malignancy may be gauged by the amount of osseous tissue in relation to them.

The least malignant (myelomata) (*Figs. 56 and 57*) have an even, rounded shape, and may not destroy life for many years. They are enveloped in a well-defined bony capsule, which may expand indefinitely with their growth. If the soft growth be thoroughly scooped out of its bony capsule a cure results, but if

they burst through this capsule, they infiltrate the surrounding tissues, grow rapidly, and declare their malignancy.



FIGS. 46, 47. ILLUSTRATING THE GROWTH OF BONE TUMOR.
(C.T.) Cartilage of head of tibia. (B.C.) Rony capsule. Note thickness when the tumor is small, becoming thinner as it grows.

The most malignant of malignant tumours are the so-called periosteal sarcomata of growing bones. They spring from the bone, and their favourite site is in the neighbourhood of the most active epiphyses. (Upper end of humerus, lower end of radius, lower end of femur, upper end of tibia.) Their growth is so rapid that they assume an irregular lobulated form; and any resistant structure met with, such as tendon, blood-vessel, or nerve, leaves its mark on their surface, because in their hurry to get big, they follow the path of

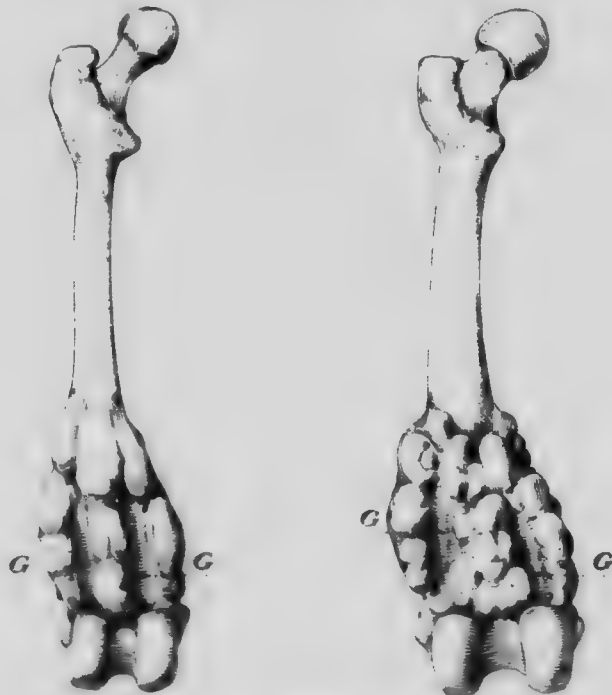


FIG. 58. PERIOSTEAL SARCOMA.

Note (G,G.) Grooves for humerus.

least resistance (*Figs. 58 and 59*). Their victims die within the year, usually from growths in the lung, and whether the most radical operation is, or is not, done.

In the intermediate group of bone sarcomata—those of neither very slow nor very rapid growth—the degree of malignancy may be estimated by the amount and density (shown by x-rays) of the osseous tissue connected with them (*Fig. 60*). Some of them, after years of slow growth, suddenly develop their malignant tendency, owing to the fact that the tumour-cells have overpowered their osseous inhibitor.

Like the pyogenic infections, those of tubercle, cancer, and syphilis, can be imprisoned by fibrous tissue and bony deposits for long periods of time.

Septic Infection.—

The evil influence of septic infection on tubercle, malignant disease, and syphilis, is insufficiently recognized. Each may have a relatively benign course till sepsis is superadded. An uncomplicated tuberculous abscess never causes constitutional disturbance or death, but when septic infection has gained an entrance to it, both frequently follow.

Most of the pain, the odour, and the discharge of cancer, are due to superadded sepsis. One of the conditions in which they are all pronounced, is cancer of the uterine cervix. I have had opportunities for observing elderly spinsters with this disease. In all, the only early symptom was hæmorrhage. Before the growth had caused serious disturbance, it had, in each instance, invaded the bladder, was infiltrating the surrounding structures, and had become inoperable.

The uncomplicated primary "sore" of syphilis is not a sore at all, but a hard, dry, raised, painless lump.



FIG. 66. — PERIOSTEAL SARCOMA.
Upper end of humerus. Note ossification.

Chronic Lymphatic Œdema.—Amongst other causes of chronic lymphatic œdema of the extremities, tubercle, syphilis, and cancer have to be remembered.

Combinations.—That of syphilis and tubercle is a deadly combination. I have seen cases in which tubercle attacked the lungs of a victim of secondary syphilis. In each instance, the tubercle rapidly advanced to a fatal issue.



Fig. 61.—MIXED SYPHILITIC AND TUBERCULOUS
DESTRUCTION OF FACE.

The most disastrous form of "scrofula" is a combination of congenital syphilis and tubercle (Fig. 61).

Cancer and syphilis are very firm allies; and syphilis often provides a suitable site for the lodgment of cancer.*

Tubercle and cancer favour the same sort of soil. Persons who have recovered from tubercle in their youth are exceptionally liable to cancer in their later years. It is more than a coincidence, that both occur in families with a history of some members having attained to an extraordinarily long life.

SYPHILIS.

Syphilis is acquired or congenital.

The cause is *Spirochæta pallida*, a delicate spirillum. (Plate II, Fig. C.)

This organism is readily destroyed by heat and loses its infective properties a few hours after removal from the body.

Syphilis is chiefly a venereal disease; but may be contracted in other ways (*Syphilis insontium*): pipes, wind instruments, infected clothing, kissing, vaccination, etc.

If a person over sixty years of age contracts syphilis, his death from cancer may be anticipated.

For practical purposes three stages are recognized—primary, secondary, and tertiary.

The Primary stage, absent for inherited syphilis, occupies four to eight weeks, and includes the period of incubation, the primary sore, and the enlargement of the nearest glands.

The Secondary stage occupies two years, and includes the symmetrical and superficial lesions of skin and mucous membranes, and general enlargement of the lymphatic glands.

The Tertiary stage is characterized by infiltration of the deeper tissues and internal organs, as well as of the skin and mucous membranes, with fibro-cellular deposits; the arteries, especially, are apt to be diseased. This stage may be of life-long duration.

Immunity is generally conferred by one attack.

The Primary Sore is a round, itching, painless elevation, which may become an ulcer or an abrasion with a *hard* base as its chief characteristic. It appears about one month after the infection. The hardness of the base has been emphasized by comparing it to cartilage. The inguinal glands, throughout their whole chain, on both sides, are of shotty hardness, and feel like almonds. Any part of the penis may be involved; but a favoured site is the angle between the base of the glans and prepuce. Sometimes a hard lymphatic cord can be felt on the dorsum of the penis running towards the glands.

In females, the primary sore may be difficult of recognition. It is usually on the labia.

In non venereal cases, the lips and nipples in women, and the fingers in men, are the most common sites.

DIAGNOSIS OF CHANCRE.

The hard chancre is nearly always solitary: *hardness* is the striking feature, and when uncomplicated, it seldom leaves a scar.

It has to be distinguished from the *soft sore*, or chancroid. This is generally multiple; appears three to six days after infection; shows signs of active inflammation; the ulcers rapidly extend; the lymph glands are more enlarged, more tender, more inflamed, and suppurate often; the whole chain on both sides is not infected as in syphilis; and the sore, on healing, leaves a scar.

There may be a double infection—syphilis and a soft sore. For six weeks it will be impossible to say there is no syphilis by ordinary examination. On the other hand, examination of the discharge, or of a scraping, may show the spirochæta, and the diagnosis is then certain.

Epithelioma may be mistaken for the primary sore. It usually occurs in patients over 50 years of age, and there is generally a history of chronic phimosi.

Herpes preputialis may also occasion doubts. It commences a few days after intercourse, with red, itchy spots which develop vesicles, secondarily small sores, and then crusts.

Secondary Syphilis appears from six to twelve weeks after the infection, as a measly rash, distributed to the skin symmetrically, and on the mucous membranes.

DIAGNOSIS OF SECONDARY SYPHILIS.

There are fever, muddy anæmia, headache, pain in the bones, general enlargement of the lymphatic glands, and leucocytosis (increase of the leucocytes).

Six Qualifications of a Syphilitic Eruption.—At a later period the skin shows :—

1. Symmetrical
2. Copper-coloured
3. Rounded or oval
4. Polymorphic
5. Not itchy, spots
6. Which yield to treatment.

When surrounding the forehead at the roots of the hair, the spots have been described as the "corona veneris."

The Nails exhibit syphilitic cracks and onychia.

The Hair is dry, and falls, or can be readily pulled out.

Mouth.—At the angles, a patch with a central crack is very characteristic.

Tongue.—"Snail-track" ulcers. Bald areas on the dorsum and at the sides, mucous patches, and cracks.

Throat.—The tonsils and palate show grey snail-track ulcers.

Nose.—Crusts on the mucous membrane of the septum.

Eyes.—From fourth to seventh month—iritis, choroiditis, and neuro-retinitis.

Ears.—There may be middle-ear infection from the throat.

Bones.—Periosteal nodes which have been associated with headache, nocturnal pains in the limbs, and tenderness on pressure. These are often marked over the sternum.

Anus and Genitals.—Condylomata, or warts (*Fig. 62*).

Later Secondary Period.—There may be synovitis—especially of the knees; double epididymitis; evidences of diffuse cerebral involvement; and palmar and plantar psoriasis.

Tertiary Syphilis.—The signs of this may appear from the second year. The lymphatic glands are now not generally enlarged; the manifestations are not symmetrical; they are those of a localized infection; they select the least vascular sites.



FIG. 62. — VENEREAL WARTS.

The lesion is a gumma which consists of three principal zones : (1) Central necrosis : (2) Beyond this, round cells ; (3) Outside of all, fibrosis (Fig. 63).

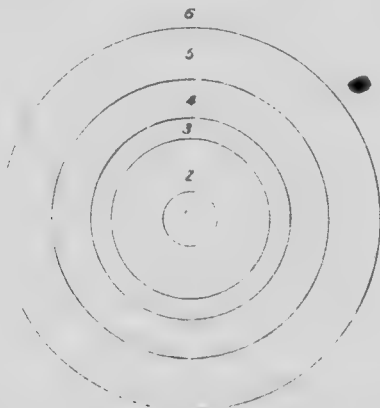


FIG. 63. — DIAGRAM OF BREAKING-DOWN GUMMA OR TUBERCLE.

1. Central necrotic area.	4. Area of small round cell infiltration.
2. Lipified tissue.	5. Area of endothelial infiltration and fibrosis.
3. Proliferative membrane.	6. Normal tissue.

When the necrotic centre is exposed, its appearance is that of a wash-leather slough.

When the slough separates, the typical syphilitic ulcer is left.*

When the ulcer heals, there is a marked cicatrix, tending to a circular shape, and pigmented round about (*Fig. 64*).

Gummata of the Skin choose the mid-line of the body, and neighbourhood of the knees. Over the deltoids, the buttocks, and the back, are also favourite sites. The face is especially liable to obstinate ulcers, and its middle line is a favourite situation.

The Bones.—Gummata of the periosteum, or deep gummata, may occur. The latter may allow of spontaneous fracture.



Fig. 64.—GUMMATOUS ULCERATION OF BUTTOCKS

Extensive caries and necrosis may follow septic infection of the syphilitic bone.

Bones specially liable are the nasal, and those of the hard palate, cranial vault, and sternum.

In the long bones a chronic inflammatory swelling in the *diaphysis* is likely to be syphilitic (*Figs. 65 and 66.*)

Muscles.—The majority of muscle-tumours are gummata.

Mouth.—Scarring at the angles, especially marked in congenital syphilis, is pathognomonic. Other evidences are leukoplakia,

* Always suspect syphilis as the cause of any ulcer which endeavours to heal for a time, then suddenly breaks down again, and spreads, as if mouse eaten, at one part of its edge.

gummata and depressed cicatrices of them, of the tongue (dorsum, affecting chiefly the midline), perforations of the hard or soft palate, absence of the uvula, scars and adhesions of the soft palate, chronic inflammations and ulceration of the larynx, and necrosis of the laryngeal cartilages.

Nose.—Perforations of the septum, sunken bridge, ozæna.

Eyes.—Signs of old iritis or choroiditis.

Viscera.—In the testes, liver, and spleen, gummata may be found ; and these can soften and break down, or cause fibrosis.

Rectum.—This may show ulcers, fistulæ, and stricture.

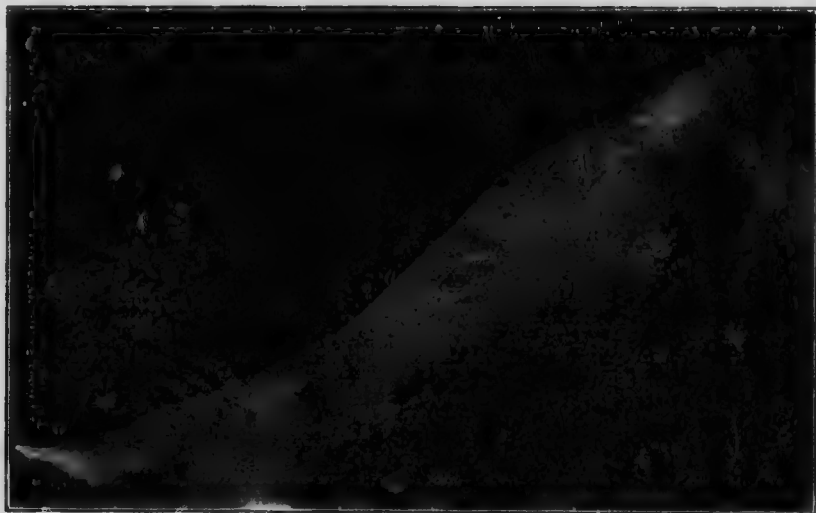
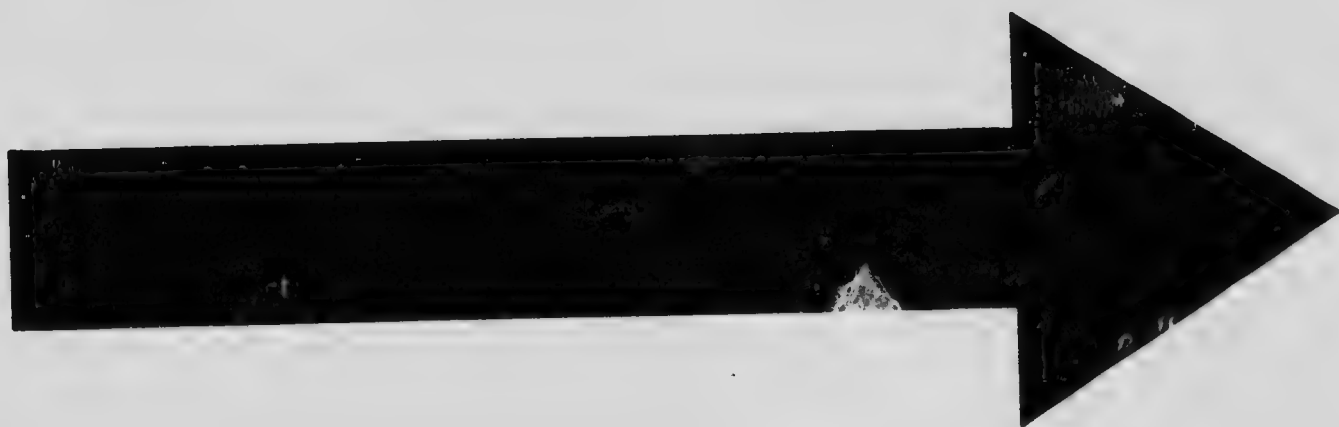


Fig. 65. SYPHILIS OSTEITIS.

Brain and Spinal Cord.—Gummata may be found, and these produce the clinical signs of tumour. The cerebral arteries may be diseased or obliterated, or aneurysms may be present. Paralysis of nerves is one of the common signs of intracranial syphilis.* Chronic meningitis, causing headache and nerve involvement ; myelitis. General paralysis and locomotor ataxia are now well recognized results of old syphilis.

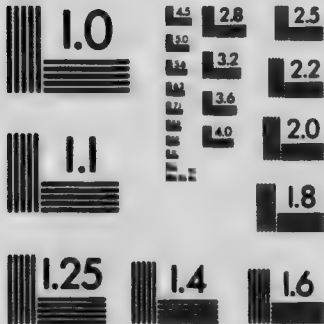
Blood-vessels.—(Arteries.) Arteritis, affecting chiefly the inner and muscular coats, and causing aneurysm and thrombosis.

* Headache—prolonged and severe—insomnia, double vision, and strabismus, suggest a syphilitic lesion



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Congenital Syphilis.—The family history is one of abortion and still-birth, produced by placental disease, or by disease of the foetal viscera.

Signs.—These appear at, or soon after birth—usually three to six weeks after—but may be as late as thirty years.



FIG. 66. - SCLEROSIS OF BONE.
Syphilitic osteitis of tibia. Diaphyseal infection.

Snuffles; sores round anus; hoarse cry; are generally the first signs.

Skin.—Diffuse dermatitis; peeling; copper spots; or pemphigus.

Mouth.—Ulcers round orifice externally leave radiating scars. Stomatitis; decayed teeth; high palate.

Anus and Genitals.—Condylomata.

Skull.—Craniotabes. Parrot's nodes.

Bones.—Epiphysitis, with pseudo-paralysis. Arthritis, which often suppurates.

General Appearance.—A syphilitic baby may look healthy when born, and later frequently looks like a shrivelled, anæmic old man.

With treatment, cure follows, and after one year may remain permanent.

Later Signs (during puberty and adolescence):—

Eyes.—Interstitial keratitis; choroiditis.

Mouth.—Radiating scars. Hutchinson's teeth (*Fig. 67*) (a notch in the permanent set of incisor teeth); peg-top teeth; palatal ulceration.

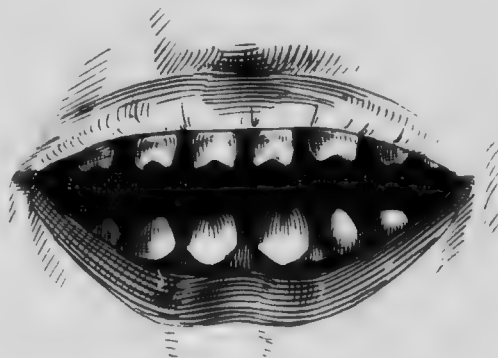


Fig. 67. —HUTCHINSON'S TEETH.
From a case of congenital syphilis.

Nose.—Sunken bridge; gummatous ulcers on skin.

Ears.—Deafness—due to disease of the auditory nerve, or of the internal ear.

Bones.—Thickening from sclerosis, may be symmetrical; Parrot's nodes (on frontal and parietal eminences); craniotabes.

Joints.—Symmetrical synovitis.

Skin.—Deep, large, obstinate gummata.

General.—Whole body may be dwarfed.

The spirochæta has been found in all syphilitic lesions, primary, secondary, and tertiary; the Wassermann reaction is present in the great majority of cases.

It is obvious, therefore, that in every stage the infection of syphilis may be conveyed to others. Experience has proved, however, that the chancre and its site are highly infective; secondary lesions, except at the chancre site, little infective; and tertiary lesions, practically not so at all. The shorter the period since infection occurred, the more active the organisms are. It seems as if, on their

first entrance to the body, they swarm unhindered everywhere, causing a general toxæmia; that later, there is an increasing tendency to localization; and that, finally (tertiary stage), the lesions are entirely local, depending on spirochætæ imprisoned in cells of fibrous tissue. Whether these confined organisms are, or are not, to work mischief in the future, depends more upon the tissue resistance than upon any other factor.

TREATMENT.

There is nothing so remarkable in medicine as the effect of treatment upon syphilis.

The Primary Sore.—If the prepuce is long, and its orifice narrow, it is essential as a first step to enlarge the opening by knife or scissors, sufficiently to allow of quite easy retraction. Neglect of this precaution may result in balanitis, gangrene of the prepuce, and possibly phagedæna. For the treatment of this last very serious complication, continuous immersion in a hot bath is the most suitable remedy. Black wash, applied on lint and frequently renewed, is an excellent dressing for the chancre.

So soon as diagnosis is assured by the discovery in a scraping of the spirochæta, by the typical induration of the chancre and enlargement of the whole chain of inguinal glands, by the appearance of a polymorphous eruption, or by a positive Wassermann reaction, the administration of mercury should be commenced.

My preference is strongly in favour of the inunction method, but social and other considerations are usually against this and a substitute has to be found.

This is my usual prescription :—

R	Hydrarg. Perchlor.	- - - -	gr. j
	Potass. Iodid.	- - - -	ʒiiss
	Aq.	- - - -	ad ʒviij

A tablespoonful to be taken three times a day in a wineglassful of water.

The medicine is to be continued for three months, or until all the ordinary signs of disease have disappeared; then left off for a fortnight; and at the end of this "holiday," resumed. On these lines the course is continued during the first year.

During the second year, if there have been no recent outbreaks, the medicine is taken for two months out of three, and must be continued at the same rate till one year has passed without any signs of disease. All my patients are recommended to take a similar course during the whole of the months of April and October, for the next seven years.

It is, however, probable, that scientific tests will soon take the place of these empirical rules, and that the progress of the patient will be guided by accurate laboratory records.

During the mercurial course, it is essential that regular attention should be given to the teeth and mouth, as any neglect of these may result in so-called mercurial stomatitis.

There are some conditions which can be much relieved by local treatment.

Mucous patches in the mouth and on the tonsils may be painful and depressing from interference with the functions of mastication and deglutition. They only become serious in the mouths and throats of persistent smokers; and the chief indication is to use tobacco, if at all, in very moderate quantity, and in the least irritating form—through a long pipe. Each spot may also be painted daily with a camel-hair brush dipped in a solution of chromic acid, ten grains to the ounce. The patient may at the same time gargle the mouth and throat after every meal with a solution of chromic acid, one grain to the ounce.

Skin eruptions, especially on visible surfaces, always cause annoyance. Their disappearance may be hurried by rubbing on to the spots each night an ointment of hydrarg. ammoniata gr. xx, vaseline ℥j.

Condylomata in connection with the anus and genital organs get well quickly if, after careful washing and drying two or three times a day, they are dusted with equal parts of calomel and kaolin, the moist surfaces being kept apart with absorbent cotton-wool.

Iritis should be anticipated, and the patient told of its possible commencement as a redness of the eye, which demands attention. It occurs chiefly in those affected by a papular eruption of the skin, and the pupil should be at once dilated with atropine in a 4 grs. to the oz. solution.

Nervous Symptoms.—The appearance of nervous symptoms, cerebral or spinal—and these may occur during the secondary period—demand energetic treatment by inunction.

Infants.—For the treatment of infants, the old-fashioned method of spreading half a drachm of unguent. hydrarg. three times a week on the abdominal binder is hard to beat.

Children.—For older children, one grain of hydrarg. c. cret. may be given twice a day.

The manifestations of tertiary syphilis—gummata, ulcers, etc.—are influenced for good by increasing the amount of iodide of potash. In cases of cerebral syphilis, for example, 30 grs. of iodide and $\frac{1}{4}$ gr. of hydrarg. perchlor., taken in half a tumblerful of water three times

a day, may be continued until all active symptoms have disappeared. Many of the chronic external gummata can be hurried away by the application of a blister, or a series of blisters, and for the more chronic—for example, those affecting adolescents, or adults who are the victims of congenital syphilis—the most satisfactory method is to dissect them out if they are in accessible situations.

A healthy, simple life, abundant fresh air, frequent hot baths, milk, eggs and cream, and freedom from excessive alcohol and tobacco, are also essential to the best results.

So much emphasis has of late years been attached to the serious aspect of syphilis, and its possibilities of far-reaching mischief, that there seems little danger of these being overlooked. There is, indeed, some chance that too unfavourable a prognosis may be formed, and I would like to dispel some of the gloom. Before coming to Newcastle, I was in practice in a seaport town (population 70,000) for thirteen years, and had large opportunities of watching the effects of syphilis, extending now over several years. Many of the patients I have known for as long as twenty years, so that it is possible to form some conclusions.

The first is, that intemperance in alcohol and tobacco are the greatest dangers to syphilitics.

Next, that syphilis has such a strong tendency to spontaneous recovery in healthy young adults, that the majority recover from its effects, and suffer from no serious sequelæ if entirely untreated.

That, with careful treatment on the lines indicated, perfect recovery may be expected; and that after three years, if an interval of one year entirely free from symptoms has elapsed, it is safe to marry.

That, in at least 90 per cent of cases, no serious after-effects occur.

TUBERCULOSIS.

Cause.—The most common cause of chronic inflammation is the tubercle bacillus. It gains an entrance to the body, in surgical tuberculosis at least, chiefly by the mouth and alimentary canal; effects an entrance to, and acquires a lodgment in, lymphatic glands; and is distributed by the lymphatic vessels.

Abdominal surgery shows that a large percentage of the population carry mesenteric glands infected by tubercle from childhood throughout life.

The chief *predisposing* conditions for its successful attack are those diminishing the vital resistance of the body.

Two types of person are universally recognized as being more than usually susceptible to this disease.

1. The pretty, soft-skinned, vivacious, blue-eyed, fair, soft-haired, lymphatic type.

2. The ugly, coarse-skinned, sluggish, brown-eyed, dark, rough-haired, phlegmatic type.

A considerable growth of downy hair on the body is perhaps the most suggestive sign of the tendency to tubercle. The pale-complexioned, red-haired, freckled, hairy-skinned Celtic is specially disposed to tubercle (and sarcoma). Childhood and early youth are the favourite ages for its occurrence.

Pathology.—A typical microscopical tubercle consists of a centre (giant cell); beyond this, a circle of endothelial cells; and outside, a layer of round cells; with other manifestations of inflammatory reaction. A number of these join to form a miliary tubercle (the smallest to be seen with the naked eye).

Tubercle bacilli may be demonstrated in the nodules by microscopic examination; or failing this, their presence may be proved by animal inoculation.

The centre of the tuberculous mass tends to break down from defective blood supply, and to soften (caseate), or liquefy and point (cold abscess). A natural cure may follow its spontaneous discharge. More commonly, septic infection of the tuberculous focus follows, and the serious results of a mixed infection declare themselves. Natural cure may also follow calcification of the tuberculous area, or its imprisonment by fibrous tissue; but the tubercle bacilli, under these conditions, may still live and reassert themselves later.

Cold Abscess.—Tuberculous (cold) abscess is one of the most important and frequent surgical manifestations of tubercle. Important, because the failure to treat it properly is so often the cause of prolonged invalidism and a painful death; and frequent, because chronic abscess occurs in a large percentage of tuberculous bone infections.*

The wall of these abscesses consists of tuberculous granulations, the inner layers of which are undergoing caseation, liquefaction, and disintegration. The contents are the debris, mixed with exudate from the blood-vessels. A more or less curdy fluid is the result, watery fluid contents predominating in one case, masses of curdled lumps in another.

The diagnosis of such an abscess may present difficulties, as its progress is so painless and so slow that it can be mistaken for other soft swellings; thus, a patient with psoas abscess not infrequently comes because trusses which he has tried "will not keep his hernia

* Where a chronic abscess is, look for the focus in some bone.

up;" and many operations for the "removal of fatty tumours" have terminated in the discovery of a chronic abscess.

For the diagnosis of the *size*, *shape*, and *source* of the sinus resulting from chronic abscess, a useful method has been added to the



Fig. 68.—SINUS FOLLOWING TUBERCULOUS DISEASE OF HIP JOINT.
Injected with bismuth paste.

resources of surgery. By the injection of the sinus with a bismuth vaseline paste, and the use of the Roentgen rays, all of these may be accurately determined (*Figs. 68 and 69*).

Aids in the diagnosis of obscure cases of tuberculosis are :—

1. *The Injection of Koch's Old Tuberculin* (a concentrated extract of dead tubercle bacilli).—After a few hours, the diseased focus swells and becomes painful, the patient feels ill, and has a rise of temperature (101° – 104° F.)

2. *The Injection of New Tuberculin* (T. R.), and observation of its effects on the opsonic index.

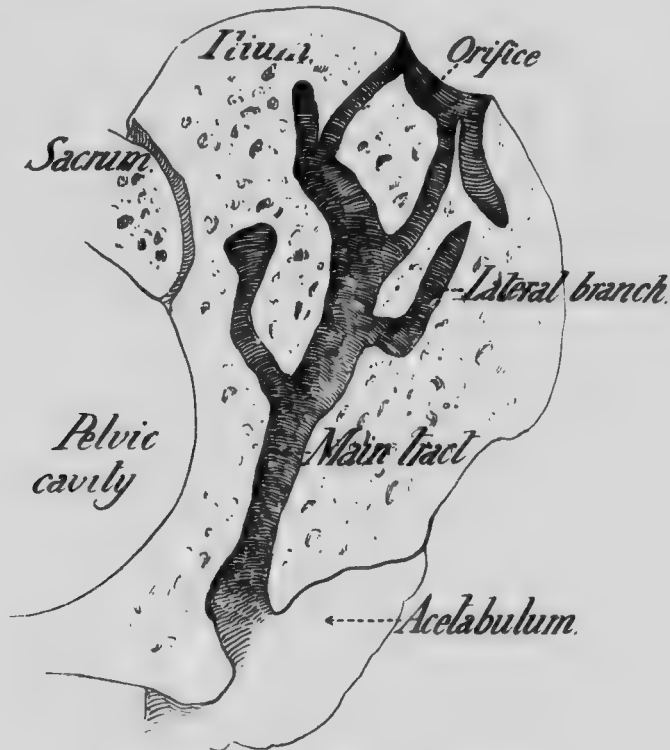


FIG. 69.—EXPLANATORY DIAGRAM OF HIP DISEASE SINUS.
Injected with bismuth paste.

3. *The Conjunctival Reaction* (Calmette).—A single drop of a one per cent solution of specially purified tuberculin is dropped into the inner angle of the eye. If a reaction (redness, smarting, and lachrymation) follows in a few hours, and persists for at least twenty-four, the result is positive; there is tubercle somewhere in the patient. There is, however, more danger in using this test than others, for destructive inflammation of the eye has followed.

4. *The Cutaneous Reaction* (von Pirquet).—This test is applied

by rubbing Koch's original tuberculin (25 per cent dilution), into a small area of skin, scratched as for vaccination. A second similar spot should be made, and rubbed with glycerin as a contrast. If the patient has tubercle there is, at the end of forty-eight hours, a rounded red papule surrounded by a circle of inflammatory blush and perhaps small serous vesicles, on the spot rubbed with tuberculin. This begins to disappear about the fifth day, and in ten days is gone, leaving a pigmented area for months.

TREATMENT.

The treatment of tubercle is (1) *General*, and (2) *Local*.

The natural tendency to cure is now receiving, as it deserves, fuller recognition. The bad character tubercle has received is due chiefly to its septic complications. So soon as these can be prevented, or satisfactorily dealt with, the prognosis is materially improved.

Before the age of ten years, surgical tuberculosis may, with a moderate amount of patience and care, be expected to recover. As life advances, the prognosis becomes increasingly serious; and after fifty years of age, recovery without a radical operation is very rare.

1. **General Treatment** aims at improving the resisting power of the patient.

The most important aids are: Fresh air, night and day; two pints of new milk and two eggs daily, in addition to ordinary food; and a general soft soap inunction every night, lathered off in a hot bath, the drying to be done with a rough towel.

In certain instances—and my own experience points most strongly to genito-urinary tuberculosis—considerable benefit is derived from the use of tuberculin injections. The administration of these may be guided by an estimation of the opsonic index, or by ordinary clinical signs. If the latter are depended on, a minimum dose of Koch's new tuberculin should be injected tentatively. If no effect is felt, or observed, a larger dose can be used in a week's time. Too large a dose is likely to occasion headache, fever, and a feeling of malaise. A suitable dose is followed by increased vigour and appetite, a general sense of well-being, and improvement in the clinical signs. When the suitable dose has been found, it should be repeated every two weeks.

The opsonic index has also been used as an indication against operation. It is said that no operation should be done when the opsonic index is low; for then general tuberculosis will probably result, through dissemination of the tubercle bacilli as a consequence of the operation.

2. **Local Treatment.**—The ideal treatment for a localized tuberculous lesion is, and always will be, its complete excision.

This should, consequently, be the method adopted whenever the operation can be accomplished without inflicting serious damage.

Joints.—When excision would entail serious damage, as in the case of joints, *rest* is the greatest curative agent.

The entire recovery of diseased joints in children may be anticipated with confidence if they are kept at rest from one to two years.

Up to thirty years of age recovery, with some limitation of movement, is likely to follow prolonged rest.

After fifty, cure does not occur; and amputation is usually the best treatment.

Next to rest, the application of *Bier's hyperemia treatment* is the greatest ordinary aid to recovery. Some surgeons are so enthusiastic in its favour as to believe that this is the most important aid, and that rest is no longer necessary.

For tuberculous abscesses, a small incision is made, and Klapp's suction-ball is applied for five minutes at a time over the opening, then the ball is removed for three minutes, and the process is repeated time after time for about three-quarters of an hour. The small wound should be dressed, and no drainage must be permitted. The operation is to be repeated daily till healing follows.

For tuberculous joints and tendon sheaths, a Martin india-rubber bandage is applied, some considerable distance above the infected part, for one hour at night and morning, and repeated daily. The bandage should be tight enough to impede the venous circulation sufficiently to cause the limb below it to assume a reddish-blue colour, and to swell; but not tight enough to cause any pain, still less to arrest the arterial pulse. The occurrence of pain demands instant removal of the bandage.

The most brilliant results we have observed have been in cases where septic sinuses were serious complications.

A variety of injections have been used, all with some success. Iodoform is the chief constituent of most of them, and probably they all act by stimulating fibrosis.

Special mention must be made of the method of injecting abscesses and sinuses with an ointment of arsenic-free bismuth. This is composed of subnitrate of bismuth one part, and white vaseline two parts, carefully sterilized; and the cavity or sinus to be treated is gently filled with it by means of a large syringe. Many obstinate sinuses have healed after a few applications; and good reports of large abscesses healed by the same means are recorded. At the same time, it is necessary to mention that serious poisoning, and occasionally active sepsis, have resulted from the use of this method. If symptoms of poisoning occur, the sinus must be thoroughly washed out with

warm sterilized olive oil. The chances of sepsis may be minimized by careful use of antiseptics in the preparation of the skin and the uth of the sinus.

Psoas Abscess.—My own belief is, that treatment by operation is most satisfactory in immediate and remote results. When the abscess cannot be excised, as is the case with psoas collections, my method of operation is offered as an example of the most serious of these undertakings.



Fig. 70.—CARIES OF SPINE.
Showing posterior end of incision for
psoas abscess.



Fig. 71.—INCISION FOR CURE OF
PSOAS ABSCESS.

The abscess is fully exposed by an incision starting at the costal margin above ; and behind, opposite the outer edge of the quadratus lumborum muscle, and continued obliquely, parallel with the intercostal nerves, forward on to the abdomen to the outer edge of the rectus abdominis (Figs. 70 and 71). After division of the abdominal muscle in this line, the transversalis fascia and peritoneum covering the abdominal contents are separated inwards, till the psoas abscess is fully exposed. This is then opened, and its contents evacuated. With retractors and a search-light, it is now possible

TUBERCULOSIS

21

to see and deal with diseased areas on the bodies of either the lowest dorsal or lumbar vertebræ. A second incision is made over the femoral prolongation of the abscess below Poupart's ligament, and with sharp spoons, sluicing, and gauze ropping, followed up by the search-light, every part of the abscess cavity is gently cleansed of any gross débris, and all bleeding is arrested. The entire wound is closed without drainage, and the results are surprisingly good* (*Fig. 72*).



Fig. 72.—PSOAS ABSCESS SCAR LEFT AFTER OPERATION.

The operation was done 14 years ago. The patient is quite well and strong.

CASE 3.—(*Figs. 70 and 71.*)—C. T., æt. 29, labourer, admitted May 21st, 1900.

History.—For the last three years he had suffered in the dorsal region of back, and was unable to work. Pain was worst on movement. The affected region was tender to the touch. When he stooped, the back seemed to lock. Two months ago he noticed a swelling in the right groin which caused him some difficulty in flexing his thigh.

Past History.—Had pleurisy four years ago, and was off work six months.

Family History.—Sister died of phthisis.

* By passing a long, sharp spoon under the ligamentum arcuatum internum I have reached, scraped, and applied iodoform paste to a mid-dorsal vertebra. This, however, is not essential, for the bone will heal with rest and suitable treatment, and the complicating abscess can be successfully dealt with independently.

Physical Signs.—(1) Swelling and deformity in mid-dorsal region ; (2) Rigidity ; (3) No pain on movement or percussion. Right groin, a swelling, with impulse on coughing, fluctuating, dull on percussion. Similar swelling above Poupart's ligament, fluctuation from above to below Poupart's ligament.

Diagnosis.—Spinal caries with large psoas abscess.

Operation.—May 29, 1900. Pus evacuated, and small spicules of bone. Cavity washed out, scraped, and iodoform paste rubbed into cavity found in vertebræ. Whole wound closed in layers ; no drainage. Wound examined after ten days—healed. Cavity appeared filled with exudate. Patient left hospital on June 29th, with poroplastic jacket.

December, 1900.—Re-admitted. Portion of external scar broken down. Tuberculous infection.

1903.—Scar soundly healed ; no hernia. Has discarded the jacket.

1904.—Gained three stones in weight. Working as a miner.

1909.—Well and strong ; wound sound ; no hernia.

The danger in these cases lies in the opportunity afforded for septic infection of the tuberculous contents of the abscess, and this danger is so serious as to have induced some surgeons to advise leaving them alone until the abscess dries up, or points externally.

If the whole of the diseased tissue cannot be excised, the wound should—with few exceptions—be left wholly open, and packed from the bottom with sterile iodoform-glycerin-formalin gauze. This allows of repeated applications to visible tuberculous surfaces (pure carbolic acid is the best) ; it insures free drainage ; and the local defensive forces are stimulated by it. This method is specially useful when sepsis is already present. Large operations on these cases are very fatal. When sepsis is present, an extensive operation should only be done in several stages. When healthy granulations cover the whole wound, it may be closed by secondary sutures.

Value of operation.—The best application of operation to tuberculous disease is as a probable preventive of extending mischief ; thus, operations, and even death from generalized tuberculosis, may be avoided by excision of the first infected neck-gland or glands ; a joint may be saved by excision of a tuberculous focus in an epiphysis ; the whole remaining genito-urinary apparatus may be preserved by the sacrifice of one kidney, etc.

MALIGNANT DISEASE.

Tumours are malignant when they are heterologous in structure (have a structure different to that of the tissue in which they are formed) ; when they infiltrate surrounding tissues ; infect lymphatic glands ; disseminate themselves through the body ; grow continuously and rapidly ; tend to recur after excision ; and destroy life.

CANCER.

Histologically, cancer consists of a riotous growth of epithelium which invades and destroys the tissues maintaining it, and which extends through the lymphatics.

The causes are (1) *Predisposing*, and (2) *Exciting*.

1. Predisposing Causes.—

a. Chronic Irritation is one of the chief of these. The smoker's lip (*Fig. 74*), the chimney-sweep's cancer, the paraffin worker's ulcer (*Fig. 73*), the *x-ray* cancer, are popular knowledge. Chronic superficial inflammation (leukoplakia) of the tongue and cheeks, the vulva and penis, so often end in cancer that they are frequently and well described as pre-cancerous conditions. The irritated scar of a burn, sustained in youth, is certain to develop an epithelioma before the patient arrives at the age of fifty (*Figs. 75, 76, and 77*). The skin of a face frequently exposed to every variety of weather is likely to develop skin cancer (*Fig. 78*). The breast change described as chronic interstitial mastitis is frequently followed by cancer.

b. Senility comes next in importance to chronic irritation as a predisposing cause of cancer. Two of the most common — skin and breast cancers — seldom occur before forty years of age. It is to be remembered, however, that the term "senility" should refer, not so much to the number of years, as to the condition of the tissues.



*Fig. 73.—EPITHELIOMA OF FOREARM.
Paraffin Worker.*



Fig. 74.—EPITHELIOMA OF LIP.
Clay-pipe smoker.

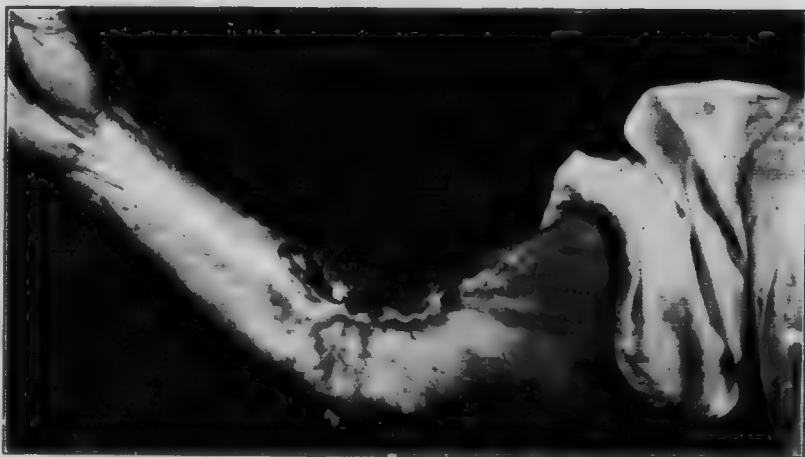


Fig. 75.—EPITHELIOMA FOLLOWING UNHEALED BURN.
Note—(1) Pigmentation; (2) Scarring; (3) Contraction (permanent flexion) and growth.



FIG. 77.—EPITHELIOMA CONSEQUENT ON OLD BURN SCAR OF LEG.



FIG. 76.—EPITHELIOMA CONSEQUENT ON OLD BURN SCAR OF LEG.

c. Simple Tumours.—Certain simple tumours, or at least those regarded as such for years, predispose to cancer. Warts (papillomata and polypi) on the skin, or in the bladder, the larynx, the colon, or the rectum, are so likely to be the precursors of cancer, that it should be a surgical rule to excise all of them, at any rate for patients older than thirty-five years. Parotid tumours, if the patient lives to old age, seldom fail to develop the signs of malignancy. Probably, all of the tumours regarded as benign predispose



Fig. 75.—SKIN CANCER.
An old field worker.

in less or greater measure to cancer. (See CATHCART, on "The Essential Similarity of Innocent and Malignant Tumours.")

d. Syphilis and Tubercle prepare the ground for cancer.

e. Worry is the last of the predisposing causes worthy of mention. It is impossible, in making a careful enquiry into the history of a number of patients, to avoid the conclusion that, somehow or other, worry has materially helped them to develop cancer.

2. **Exciting Cause.**—The exciting cause still defies the efforts of numberless investigators engaged in the search for it; and is unknown. Whatever it may be, cancer is spread over the whole world; attacks animals of all sorts as well as man; and is increasing in quantity as well as in malignity.

There is considerable evidence in favour of the view that cancer is infectious. That it is infectious to the person already attacked is certain, for there are too many recorded cases of cancerous sores forming on points opposed to other similar ulcers, to be explained away as coincidences, and the infection of an operation-wound by a cancer cut into during its removal, is universally recognized as a danger to be avoided. That it is infectious to others seems probable



FIG. 79.—EPITHELIOMA OF SIDE OF HEAD.
Cock's tumour.

from evidence which has been collected with regard to epidemics and "cancer houses." That it can be transplanted from one animal to another of the same species, and cause cancer in the animal so treated, has been proved by innumerable experiments.

Commencement.—It commences as a single local lesion which, with few exceptions, disseminates more or less rapidly through the lymphatics, any cells escaping into the blood being destroyed. The local lesion may be a crack; an ulcer; a warty tumour (Fig. 79); or a nodule in the substance of the infected tissue.

Method of Spread.—The infected glands are those into which the lymphatic vessels of the infected region immediately empty themselves; and as the lymphatic vessels and glands offer consider-

able resistance to the progress of cancer in all cases, it remains for some time localized.

When the resistance of the lymphatics has been broken down, the cancer may find an entrance to the blood-stream and become disseminated by it.

The secondary lesions always possess the same character of cells as the primary growth; that is, a cancer of the rectum produces a columnar-celled (rectal-mucous-membrane-cell) cancer in the liver; the bone growths secondary to cancer of the breast, possess the appearances characteristic of breast cancer; secondary thyroid, and prostatic and kidney growths may be found anywhere. The chief seats of secondary growths are serous membranes, lungs, liver, kidneys, and bones.*

CLASSIFICATION.

Cancers are classified according to the variety of the cells in the tumour.

Epithelioma may occur in any site covered by stratified epithelium: skin, mouth, larynx, etc. It is chiefly distinguished by its local malignancy, for it rarely extends beyond the local lymphatic area, and kills by local invasion.



Fig. 80.—DIAGRAM OF RODENT ULCER.
(C) Shallow cavity. (B) Smooth, wire-like edges. (A) Normal skin.

One variety of epithelioma, rodent ulcer (*Fig. 80*), whose favourite site is the face in the neighbourhood of the lower eyelid, is only locally malignant. It springs from the epithelium of the sweat or of the sebaceous glands, and never infects the lymphatic glands; but slowly spreads, destroying everything it attacks—skin, muscles, bone, eye, etc. In some skin epitheliomata which attack the face, I have several times seen spontaneous healing occur; but in those cases I have been able to watch an outbreak at the same spot has sooner or later followed the apparent cure. In some epitheliomata, the secondary glandular infection assumes an appearance

of so much importance that the primary lesion may escape all but the most careful observation. This is specially apt to occur when

* When a spontaneous fracture or a bone tumour occurs in an elderly patient, examine the breast, the prostate, the thyroid, and the kidney (hypernephroma) before concluding that a growth is primary in the bone.

the primary lesion is insignificant, and it may be remarkably so. I have seen an epithelioma no larger than a big pin's head, between the toes, and causing no trouble there, give rise to an enormous glandular swelling in the groin: and my impression is, that large glandular tumours with a small primary focus are more frequently met with in the groin and on the foot than elsewhere in the body.

Chorion Epithelioma occurs in the uterus after miscarriage or labour, and occasionally in the neighbourhood of the testicle. It consists of tissue-like chorionic epithelium, and is *early disseminated by the blood*, secondary growths then appearing in the lung. Its chief surgical interest lies in the fact that, after extirpation of the primary focus, the secondary lung infection *may* disappear, and recovery take place.

Spheroidal-celled Carcinoma is the ordinary breast cancer, and occurs also in the stomach. It is of a hard (scirrhus) and of a soft (encephaloid) variety. The softness or hardness depends upon less or more fibrous tissue in the growth. It disseminates by the lymphatics, and under certain circumstances, specially attacks and invades the lymphatic vessels in anatomical relation with the skin. The form of breast-cancer known as cancer en cuirasse arises in this way.

Columnar-celled Cancer is the common cancer of the alimentary canal, especially of the rectum and colon. It disseminates by the lymphatics chiefly, and occasionally by the blood-stream.

DIAGNOSIS.

Ulcer.—The cancerous ulcer is chiefly characterized by the fact that it shows **growth in excess of destruction**. This is usually



Fig. 81. — DIAGRAM OF EPITHELIOMATOUS ULCER.

Growth in excess of destruction.
(A) Normal skin. (B) Heaped-up edges. (C) Ulcer portion of destruction.

most marked at the edges, which are raised, irregular, nodulated, and hard (Fig. 82).

Tumour.—Estimate (1) its consistency, (2) surface, (3) edge, and (4) relation to surrounding parts:

The cancerous tumour is hard, often stony hard ; has a nodular surface ; an edge which cannot be accurately defined all round ; is fixed to the tissues in which it lies, and invades the surrounding structures and lymphatic glands.

The primary growth often chooses sites in which the vascular supply is best, such as margin of lip ; side of tongue ; lesser curvature of stomach ; trigone of bladder ; and still more often, sites at the junction of two different surfaces—for example, skin and mucous membrane of lip ; pharynx and œsophagus ; œsophagus and stomach ;



Fig. 82.—SKIN EPITHELIOMA.

Notice the growth in excess of destruction.

pylorus and duodenum ; ileum and colon ; and rectum and anus : but the most frequent site of all is the skin.

Symptoms and Signs.—It cannot be too strongly emphasized that, in the early and hopeful stage of cancer, there is no pain ; there are no alarming symptoms ; and the physical signs are not likely to be characteristic. The symptoms and signs usually described, and believed to be characteristic of cancer, are the symptoms and signs of the advanced disease ; and more often than not complicated by septic infection. It is usual to get a history from patients with cancer of the discovery of an ulcer, or of a lump, months before there

was any discomfort, or other recognized occasion for alarm. What symptoms and signs should cause fear of the possibility of cancer?

Hæmorrhage.—Bleeding from the stomach; from the bowel; from the bladder; from the kidneys; from the uterus; or from nasal polypi, in elderly patients always suggests cancer, for it is the most probable cause.

Chronic Irritations.—An ulcer on the tongue which does not heal within ten days after the extraction of a jagged tooth, or which does not show very definite signs of healing within ten days after the administration of syphilitic remedies, should be regarded as cancerous, till the contrary is proved by microscopical examination. The same rule applies to ulcers elsewhere, and it is specially necessary when the patients are over thirty-five years of age.

Leukoplakic patches, especially when irritable or showing ulceration, are, if not cancerous already, the precursors of cancer; so are irritable or ulcerated warts; cracked and irritated burn scars; raised pigmented rough patches on the skin; and sores on the nipple which resist ordinary treatment.

The Discovery of a Tumour.—Every tumour which does not offer a definite history, and present symptoms and signs of its benignity, should be assumed to be malignant till the contrary is proved by microscopic examination. This rule should be made absolute in regard to patients over thirty-five years of age, and to situations in which malignant tumours are of frequent occurrence.

For example, abdominal tumours in adult males, eight times out of ten are malignant. It should also apply absolutely for certain varieties of tumours. The ordinary "benign" adenomatous polypus of the rectum or colon should always be suspected, except in the case of a child, when it is generally simple. I have watched no adult case of adenomatous rectal or colon polypi, in which cancer of the bowel failed to develop. The majority of breast tumours in elderly women are cancers.

The danger of incising the tumour to see what it is, must be emphasized. Such a course may lead to rapid diffusion of a malignant growth. It should be excised along with an area of healthy surrounding tissue before it is explored; and a pathologist should be ready to offer an opinion after making a frozen section, so that an immediate radical operation may be undertaken if necessary.

The Symptoms of Obstruction from stricture in the hollow viscera always suggest cancer.

Twenty-nine out of thirty patients who have difficulty in swallowing from recently-developed œsophageal strictures, have cancer. A smaller, but yet a large, percentage of patients with intestinal obstruction due to stricture of the colon or rectum, have

cancer. The larger number of pyloric strictures, developing after forty years of age, are due to cancer. Jaundice, resulting from chronic obstruction of the bile-duct, commencing after forty, is also generally due to cancer.

Laboratory tests have been employed for the discovery of cancer. One of the most promising of these is based upon the fact that normal serum does not hæmolyse normal blood corpuscles, but that the corpuscles of a cancer-patient may be hæmolyzed by normal blood serum.

None of the suggested tests are yet, however, sufficiently perfect or reliable. We await with hope further experimental results.

General Condition.—Loss of weight, anaemia, and the appearance of serious illness, presented by the patient, may be aids to diagnosis and suggest cancer. The so-called cancerous cachexia appears too late to be of much practical help.

It is well not to forget that the general appearance of a patient, even with advanced cancer, may be that of rude health.

PROGNOSIS.

To offer a general practical prognosis is easy. Unless the cancer can be removed, a fatal termination is inevitable.

It is difficult, or impossible, to offer an opinion of any value as to probable duration.

The greatest aid is to be found in a knowledge of the previous rate of growth, and the extent to which the cancer has invaded its surroundings in a certain time; for, as a rule, the same degree of malignancy is maintained throughout.

Cancer, speaking generally, grows with great rapidity in young persons, and slowly in very old ones.

The harder and more defined the growth, the better the prognosis. The more closely cancer resembles an inflammatory swelling, the worse the prognosis; the more localized the tumour, the better it is. A soft growth in a young patient is likely to be of the most malignant type, and to destroy life in as many weeks as a hard growth requires years to kill an old person. Fibrosis is the cause of hardness; and fibrosis is an attempt at natural cure.

The situation of the growth is also to be taken into account. Skin cancers generally are less malignant than those occurring elsewhere; but much finer distinctions may occasionally be drawn. As a rule, cancer of the lower lip possesses a low malignancy, while cancer of the lip at the angle of the mouth has a malignancy as high as that of the tongue.

The greater part of a prognosis is dependent upon complications

arising in the course of a case, such as sepsis, hæmorrhage, and the invasion of parts important to life; for example, lungs, stomach, larynx, bladder, intestine, etc.

TREATMENT.

Excision by the knife still holds the field in the treatment of cancer, and the earlier the growth can be removed the better. It is, at present, in the recognition of pre-cancerous conditions, with a

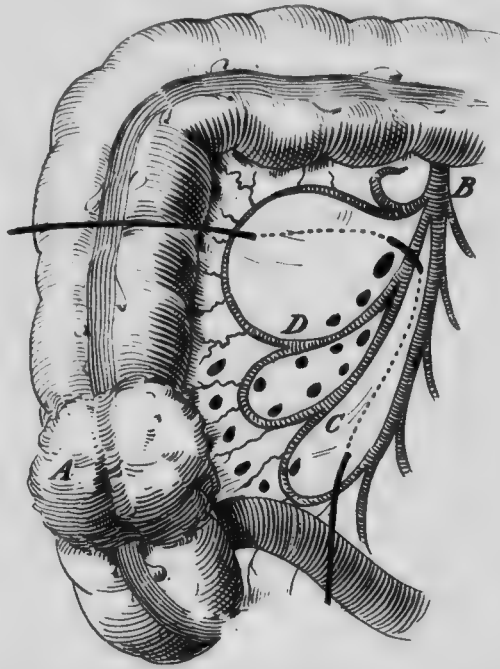


Fig. 83.—DIAGRAM TO ILLUSTRATE COMPLETE REMOVAL OF FOCUS OF MALIGNANT DISEASE (Jamieson and Dobson).

The black lines indicate the limits of the parts excised. (A) Growth. (B) Superior mesenteric artery. (C) Ileocolic artery. (D) Middle colic artery.

view to their timely removal, that the possibilities of advance in the treatment of cancer mainly lie.

Operation.—The *principles* to be borne in mind for the proper performance of a cancer operation are simple; their execution often demands the greatest skill in surgery.

Radical Operation.—The growth, with its surrounding lymphatic vessels, should be widely removed in one mass, with the whole lymphatic gland area into which it drains (Fig. 83).

The growth ought not to be cut, or burst, or squeezed, during its removal, lest the cancer-cells be driven into the surrounding tissues, and thus infect them.

Operations on these lines are followed by such increasing success, that in favourable cases not less than 60 per cent are permanently cured.

Palliative Operations.—So long as cases of cancer are allowed to drift into hopeless conditions, palliative operations will require to be performed.

Their most successful application has been for the relief of mechanical obstacles produced by the cancerous growth; e.g., tracheotomy in laryngeal obstruction, gastrostomy in œsophageal obstruction, gastro-enterostomy in pyloric obstruction, lateral anastomosis and colostomy in intestinal obstruction, ovariectomy for pressure symptoms, etc. From the patient's point of view, the most satisfactory of them leave no visible deformity or incapacity; for example, intestinal anastomosis—gastro-enterostomy. Others—tracheotomy, gastrostomy, colostomy—should not be done until the need for them is fully apparent to the patient himself.

A second satisfactory use of palliative operation arises from knowledge of the fact that many of the worst symptoms are produced by septic infection of the cancer; and that if the sepsis can be removed these symptoms will disappear, giving much relief to the patient, and prolonging life.

The oldest and most noted example of this is afforded by excision of the tongue; but the excision of a septic gastric, intestinal, uterine, or breast growth may be followed by equal relief; and I think these operations should be more frequently performed than they are, because it may be accepted as a rule, that growths are most active in the primary focus, and that if this is removed there is a chance of slower progress.

Even less may suffice. One *young* woman I saw with inoperable cancer of the cervix uteri, giving rise to profuse hæmorrhage and fetid discharge; and who, in the ordinary course of events, did not appear to have five months to live; survived in comfort for five years after the use of a sharp spoon and the thermo-cautery, with frequent continued antiseptic dressings.

Starvation of the Growth.—Some fair results have followed ligature and excision of the arteries of supply in inoperable cases—linguals in tongue cancer; external carotids in jaw cancer; internal iliacs in cancer of the cervix, etc. When recurrent hæmorrhages occur, these operations should be done.

Electricity.—*X-rays.* Some cancers, especially those of the skin, are curable by x-rays. The most favourable are those known as

rodent ulcers, which usually occur on the face. The pain, discharge, and ill-health of open, septic, inoperable cancers may be much benefited by the use of x-rays. It is probable that their use after operation is an aid to the processes which favour natural cure by fibrosis.

Fulguration.—Treatment by electric currents of high frequency and tension, and *radium* rays, have also been used with advantage; but up to the present time the results have, on the whole, been disappointing.

Transfusion of Blood.—Experiments on animals, and a small amount of experience derived from clinical observation, suggest that blood transfusion may be useful occasionally.

General Treatment.—No one, so far as I know, has yet carried out a systematic treatment of inoperable cancer on the same lines as that which has proved so successful in tuberculosis. Such treatment could scarcely fail to be a valuable aid to every other measure hitherto mentioned, and would probably furnish some surprises. There can be no doubt that the body offers considerable resistance to the invasion of cancer, for a natural cure has resulted in cases where the diagnosis was based upon indisputable evidence, and even when the circumstances of the patients were such that no help at all was afforded by their environment. Patients who have been operated upon for cancer should live as much as possible in the fresh air; change their environment if they can; and as far as possible cultivate a philosophic frame of mind. In only two cases of cancer of the breast have the patients—both relatively young women with malignant types of growth, and involvement of the axillary glands—implicitly followed my directions to this effect. It is noteworthy that they are both alive and well, the first operated upon eight, and the second six, years ago.

In hopeless cases sufficient doses of opium, castor oil, and wine (alcohol), should be given daily.

SARCOMATA.

There are, in typical instances, marked clinical distinctions between cancer and sarcoma, and the histological character of each is well defined. As a consequence no relationship, except their malignant influence, has been recognized until recently, and every endeavour has been concentrated on finding new proofs of their being things apart. In addition to clinical and histological evidence that the one may become the other, there is now experimental proof that sarcoma may be grown from a transplanted cancer, and that a similar exciting cause is common to both.

Histologically, the sarcomata consist of tumours composed of embryonic connective tissue, containing abundant blood-vessels so thin-walled that, in places, the blood appears to be in contact with the cells and stroma of the tumour.

Predisposing Causes.—

Traumatism.—There is so much evidence that a sarcoma may develop at the seat of a recent injury, that, remarkable as the conclusion may be, it is evident that accident is a predisposing cause of the disease. *Desmoids.*—One of the most striking examples of this known is the so-called desmoid tumour—histologically a fibro-sarcoma—of the abdominal wall. The clinical features are so well marked that it can scarcely be mistaken for anything else when these have been learned. It occurs in women after a recent pregnancy (other conditions causing great stretching and strain of the abdominal wall are said to have preceded it, but I have no knowledge of them), as a hard tumour, most frequently in the rectus muscle and at its upper part; less often in one of the obliques. If in the rectus, it is vertical, and elongated in the direction of the muscle; and is fixed and made prominent when the muscle is put into action. If in the obliques, it is usually found as an elongated rounded swelling, lying obliquely above Poupart's ligament. If freely removed, it usually does not recur, but the freest incision cannot ensure this. One of my patients died through local recurrence after four extensive operations; others have returned for a second operation when the first was too limited.

Too many patients with bone sarcomata date the appearance of a tumour after injury to permit of coincidence as the explanation.

Age and Sex.—Sarcoma is attached to no particular period of life, but attacks persons of any age, or of either sex.

Simple Tumours.—Certain tumours, generally regarded as simple, predispose to the development of sarcoma. There is a condition of multiple, soft, fibrous skin tumours described clinically as molluscum fibrosum. Dissection shows that it is associated with similar enlargements on the nerves (neuro-fibromatosis). Patients with this disease so often develop sarcomata of the nerve trunks, that it seems probable that all of them, in the natural course of events, will die of sarcoma, just as certainly as patients with multiple polypi in the rectum and colon will die of cancer.

Scars.—Some scars, especially those consequent upon burns, or the results of operation for tubercle, may develop into tumours called keloid, histologically often fibro-sarcomata. After reaching a certain size keloids grow no larger, remain unchanged for many years, and then tend to atrophy. These tumours so often recur locally,

and with increased malignity after excision, that no attempt should be made to remove them by operation. One patient consulted me with a stationary scar keloid on the abdominal wall, not larger than a shilling piece. The burning irritation of it made her desire its removal; but I refused to do any operation. Ten years later I saw her again. She had a keloid on her abdominal wall not less in circumference than a saucer, after six operations for the removal of the growth. She had attempted to commit suicide, and was still anxious to have a further attempt made to excise the tumour.

The tubercle bacillus and septic organisms have been found in the keloid following operations, and occasionally a small tuberculous focus shows itself at one or other part of the scar following operation for tubercle, suggesting that a modified septic or tuberculous infection may cause keloid. To get over this difficulty it has been proposed to call the scar growth associated with sepsis and tubercle, pseudo-keloid, but this would be of doubtful utility. There is, however, one point worth remembering in connection with this variety of keloid. It is that Roentgen rays may very rapidly cause its disappearance.

Epulis.—This tumour may occur in connection with the alveolus of a *septic tooth*. One variety has the histological and clinical characters of a sarcoma, and tends to recur after removal.

The Exciting Cause of sarcomata, like that of cancer, is unknown.

Commencement.—Like cancer, it rarely begins otherwise than as a single local lesion; but, unlike cancer, it does not usually disseminate by the lymphatics, or infect the glands.

Method of Spread.—The primary lesion is a tumour which disseminates through the veins; and secondary deposits first infect that viscus, the capillaries of which first receive blood from the infected source. The text-book reason offered for this blood-distribution is the much more close relation of the tumour tissue to the blood-vessels in sarcoma than in cancer. But it has been proved abundantly by post-mortem and microscopical research, that cancer-cells are constantly found in the lung capillaries of persons who have died from cancer, showing that the difficulties which cancer encounters in effecting an entrance to the blood-vessels have been overcome. That secondary deposits in the lung are as rare in cancer as they are common in sarcoma shows that, for some reason, cancer has a greater difficulty than sarcoma in growing in the lung capillaries. What is the explanation? It is known that cancer-cells are destroyed by the blood, the stages through which they pass in their slaughter and disintegration having been carefully observed in thrombi from the lung capillaries. The same is not known of sarcoma cells. It

may be, though it seems improbable, that sarcoma cells resist destruction by the blood. It appears to be more probable that infection by embolism, and its more frequent occurrence in sarcoma, is the explanation. Doubtless a sarcomatous embolus, if small enough, may be totally destroyed in the blood; but if sufficiently large to survive, it could form an adhesion and become a tumour as surely as, and in a similar way to, one experimentally grafted. When an embolism of microscopic size is arrested in a lung blood-vessel, and is not large enough to cause immediate death, an infarct results, and the ordinary clinical evidences of embolic infarction should be observable if this explanation be the correct one. They are a stitch in the side and a catch in the breath, followed by cough, blood-spitting, and a patch of pleural friction. I have seen all of these occur in sarcoma.

Secondary deposits, as in cases of cancer, resemble the primary focus: for instance, in certain osteo-chondro-sarcomata, the growths in the lungs contain bone or cartilage.

There are notable exceptions to the rule that sarcomata do not involve the lymphatic glands, or spread by the lymphatic vessels. One of the most malignant of growths is called melanotic sarcoma. It starts usually as an insignificant-looking, painless, subcutaneous nodule, which for a time grows slowly and causes to the uninitiated no alarm. After a time, the nearest glands become involved, then wider and wider areas under the skin; and finally, if the patient lives long enough, melanotic growths develop in every part of the body. The earliest and widest excision often fails to arrest this serious disease.* The foot appears to be a favourite site for melanotic sarcoma.

Another sarcoma (lympho-sarcoma) finds its primary focus in a lymphatic gland and, like cancer, extends to the lymphatics. The tonsil and the testicle are also notable exceptions, for sarcoma primary in them attacks the nearest lymphatic glands.

It is noteworthy that the tonsil, lymphatic glands, and testicle all have a definite capsule. Is it possible that this may prevent pieces of growth from escaping as emboli into the larger veins?

CLASSIFICATION.

Sarcomata are classified according to the anatomical character of the cells and of the stroma. From their cellular characteristics they are known as small and large round-celled, small and large spindle-celled, mixed-celled, lymphangio, and giant-celled sarcomata.

* In a rare case of *melanotic cancer* of the fore part of the foot which I saw, Syme's amputation, without removal of glands, effected a cure, so that *melanotic cancer* may not possess the same malignancy?

From the characteristics of the stroma they are described as chondro-osteo, petrifying, and myo-sarcomata. When containing pigment, they are called melanotic sarcomata and chloromata.



FIG. 84.—"PERIOSTEAL" SARCOMA OF THE ULNA.

DIAGNOSIS.

The diagnosis of a bone sarcoma may be made definite by x-rays (*Fig. 84*).

A tumour which has most of the signs of but is not an aneurysm, is a sarcoma.

The discovery of a recent tumour, especially if connected with skin, fascia, or bone, should suggest the possibility of sarcoma. So should soft cystic areas in a solid growth (cystic degeneration is common in sarcoma), sudden increases in size (haemorrhage into it), or egg-shell crackling.

The black colour of a melanotic sarcoma, or the green colour of a chloroma, make their diagnosis relatively easy.

All large solid, and all large bone, tumours of recent growth are sarcomata.

SYMPTOM AND SIGNS.

As in cancer, so in sarcoma, there are no pathognomonic symptoms or signs. The tumour has consequently been mistaken for all of the inflammatory swellings; for the callus of fracture; for a benign growth; and for cancer. There is usually pain, ranging from discomfort to agony, according to the degree of tension; consequently, the rapidly growing *endosteal* tumours are those in which severe pain is a marked feature. A sudden increase of the pain, attended by enlargement of the growth, suggests haemorrhage into it, and a sarcoma. Multiple soft spots suggest cystic degeneration, and this is very usual in sarcoma. As a test, this fact is most useful in distinguishing between a Brodie's bone abscess and a sarcoma, for in abscess the soft spot is single. If a joint swelling resembles a tuberculous arthritis, and has, throughout its development, been accompanied by extraordinary pain, it is probably the result of a bone sarcoma which has eroded a passage into the joint (*Fig. 85*).

PROGNOSIS.

This depends upon the clinical history, and upon microscopical evidence.

In the soft, rapidly-growing tumours of young persons the prognosis is worst. Lung metastasis occurs within a few weeks of the discovery of the growth, and death shortly follows.

Slow-growing hard tumours may take years to run their course, which means that the active cellular elements are kept in check by surrounding fibrosis or ossification.

Microscopically, help may be derived from a knowledge of the character of both cells and stroma. The soft, most malignant growths, are composed chiefly of round cells; the more highly developed, and the less resembling embryonic tissue the cells are, the better the prognosis. A dense, large fibrous, osseous, or cartilaginous stroma, with few cells, means slow development.

The pigmented sarcomata run a specially malign course.



FIG. 85.—BONE SARCOMA INVADING THE KNEE JOINT.

TREATMENT.

Wide and early excision is *the* treatment for sarcoma, when it can be carried out before secondary deposits have developed. These occur so early that in the more rapidly-growing tumours the most complete operation is often a failure. It is wrong to continue to amputate entire extremities on the off chance of curing rapidly-growing sarcomata when past records show, as they do, that chance to be so small. Other less destructive means have been tried, and even now their showing is better than those of so-called radical operations. One method is to remove the interior of the growth as far as convenient, to swab the raw surface with pure carbolic acid, followed, after half a minute by alcohol, to neutralize the acid, and to pack the cavity. In a few days, when all tendency to bleed has disappeared, a course of x-ray applications to the remains of the tumour is commenced, and continued for some months after all growth has disappeared.

Another method is based upon the observation that an attack of erysipelas in cases of sarcoma has occasionally been followed by disappearance of the tumour. Dr. Coley, of New York, introduced a fluid consisting of the mixed toxins of the streptococcus of erysipelas and of the bacillus prodigiosus for use in these cases, and in his hands the results have been so remarkable as to call for more attention than they have even yet received. With proper care, and in suitable doses, it has been proved that the use of these remedies is safe, and it has also been placed above all doubt that a fair percentage of inoperable cases have been permanently cured by them. One patient under my own care has for three years remained cured of an inoperable recurrence, after two operations for a rapidly-growing sarcoma of the groin. Those who refuse to accept such evidence as has been offered in support of this treatment, fail in their duty to these, at present, otherwise hopeless cases. My present view is that x-rays and Coley should be used conjointly.

Experimental work offers promise of help in the treatment of sarcoma. Certain dogs are immune to sarcoma. Other dogs succumb to it readily. If a dog affected with sarcoma is bled as far as it is possible to do it, and is then restored by the transfusion of blood from an immune dog, the growth of the sarcomatous dog disappears.* There is, of course, proof required that dog sarcoma and human sarcoma are similar, though there is strong evidence, such as their histology, and method of dissemination, that they are.

* Practical Medicine Series, "General Surgery," 1909, Murphy.

HÆMOPHILIA

The popular name for a hæmophiliac is "a bleeder," which is sufficiently expressive. The fully-developed example of this condition is well-known. He is always in typical cases a male; with the tendency to bleed from small cuts, abrasions or tooth extraction, so seriously and continuously as to endanger his life; with a tendency to extensive ecchymosis after the slightest bruising; with changes in his joints resembling those produced by osteo-arthritis, the result of repeated intra-articular hæmorrhages; and possibly hard nodules or lumps in his muscles from old blood extravasations. He usually can give a family history demonstrating hereditary tendency, handed down from the father and through his daughter, who escapes, to her sons.

In the *worst* cases, death occurs in youth as a consequence of the strong tendency to bleed. Those who survive the early years, tend to improve as they become older. The *mildest* cases are those with only an exceptional tendency to bleed, and it is difficult to say in this connection where physiology ends and pathology begins.

Every surgeon must have observed the different tendency to bleed exhibited in operations by ordinary individuals. Diffuse capillary oozing and active hæmorrhage from small vessels is not uncommonly noticed after making the skin incision in some persons, whilst in others scarcely a drop of blood follows an incision made in the same position. The truth is, that the tendency to loss of blood depends more upon the individual than upon any other factor. It is at least true to say that, whilst one person may bleed to death from a very small artery, another can recover from a wound of any except the largest.

Another individual peculiarity is, that the tendency to bleeding in some is specially localized to a particular part or organ. One person will readily bleed from the nose; another from the throat or the stomach, the rectum, the bladder, or the uterus; and, though it is true that skilled examination can usually offer some definite explanation, the pathological condition discovered does not provide the whole reason. Hæmorrhoids will never bleed, or only to a trifling extent, in some individuals; the same lesion in others is accompanied by profuse and repeated hæmorrhages. A similar statement applies to stomach, bladder, uterine, and other diseases, in all of which not the gross pathology alone counts, but also the individual tendencies. It may be as important to know these as to know how blood loss has been tolerated on previous occasions.

WOUNDS.

An injury which produces no breach in the continuity of the skin is not described in surgical books as a wound, however much destruction of the deeper tissues may be caused by it. This emphasizes, perhaps better than anything else, the importance of the skin as the chief protection to the body.

Such deep wounds, with an unbroken skin, are called **contusions**, **bruises**, or **simple fractures**, and the chief evidence of them is afforded by the signs of deep hæmorrhage. The lacerated blood-vessels usually bleed into the surrounding cellular tissue, and the blood travels in the direction of least resistance. When it arrives at the skin, producing the characteristic blue-black appearance, it is called an *ecchymosis*. When it escapes into a closed cavity, for example, the tunica vaginalis, it is described as a *hæmatocoele*. When, for any reason, it is localized, it is said to be a *hæmatoma*; and later on, this may form only a *cyst*, the corpuscles and all except some clear serum, having been absorbed. Apart from the severity of the injury, it is safe to say that deep hæmorrhage is the only, and a rare, danger of this variety of wound; for suppuration, unless infection be allowed to enter by insufficient care of the skin, or be introduced by careless instrumental exploration, is extremely uncommon. The amount, or the position, of a deep hæmorrhage, may be an aid to diagnosis; thus, a large diffuse subcutaneous hæmorrhage in the arm or the leg is strong evidence, even when other ordinary signs are absent, in favour of a fracture, because the vessels of the bone being fixed in bony canals, can neither contract nor retract, and the veins are relatively large, have no valves, and bleeding from them is steady and continuous. The fan-shaped subconjunctival hæmorrhage which occurs over the external rectus muscle of the eye a day or two after a head injury, is strong evidence in favour of a fracture of the anterior fossa of the skull.

It was the extraordinary freedom from danger of such injuries, and especially a comparison of the results in simple and compound fractures, that led to the introduction of the subcutaneous methods of operation, some of which (tenotomy, osteotomy) still continue to be used.

The treatment of such injuries is to endeavour, so far as possible, to limit blood extravasation; and when this has occurred, to help the absorption of it. The first indication is met by the use of continuous elastic compression, best made by the application of abundance of cotton-wool, and over this a firm bandage; the second, by the same measure aided by massage to hasten absorption.

The text-book division of wounds is into **incised**, **lacerated**

and contused, punctured, and gunshot. The characters of the gunshot might be summarized as a mixture of all the other varieties. Healing is described as occurring by first intention ; by second intention ; by the union of two opposed granulating surfaces ; by granulation ; scabbing ; under a blood-clot, etc.

The most useful classification of wounds divides them into two varieties, *the aseptic* and *the septic*; and the important thing to remember concerning healing is, that whether a wound is to unite either with a minimum of pain, with no more loss or destruction of tissue than has resulted directly from the injury, and in the shortest space of time ; or whether, after a serious and painful illness arising from inflammation and suppuration in the wound ; fever—the result of these—and a prolonged and unsatisfactory treatment ; depends nearly altogether upon the exclusion of organisms from, or their admission to, the wound.

An Aseptic Wound, the surfaces of which can be brought satisfactorily together, may be relied upon to heal by first intention. If sloughing or gangrene occur as the result of the injury ; if the surfaces are forced apart by accumulation of blood inside ; or if unrest does not allow of immediate union, the granulations covering the surfaces of the wound secrete no pus ; there is no pain or serious constitutional disturbance, and healing steadily progresses in spite of every drawback.

TREATMENT.

As the most perfect healing occurs in subcutaneous wounds, consideration of the conditions peculiar to them should serve as a useful guide to satisfactory wound treatment, assuming that the surgeon has complete control, as he should have in an operation case.

In such a subcutaneous wound :

1. Micro-organisms, chemical irritants, and air are excluded.
2. Continuous pressure is exercised on the wounded structures by the undivided elastic skin.
3. There is a minimum of interference with the wounded structures. No dressings, no drainage tubes, no sutures, no ligatures.
4. Heat is retained by the unbroken superficial parts.

How are the entrance of micro-organisms and the risks of wound infection to be prevented ?

Organisms may be conveyed into the wound by the hands of the surgeon or his assistants, the skin of the patient, talki ; over the wound, instruments, sponges, ligatures and sutures, clothing, dressings, and the air. Their entrance is to be prevented by

unremitting scrupulous care, and conscientious attention to every detail of this knowledge; and nothing is more certain than that the more perfect the methods of carrying these details into practice, the more nearly approaching perfection results will be.

In the operating theatres there are daily opportunities for observing how these measures may be effected; how the wound is protected from the hands of the surgeon, his assistants, and nurses, by prolonged cleansing and disinfection, and the wearing of india-rubber gloves; how the patient's skin is purified, and the wound protected from it; how the effects of talking into the wound are avoided; how instruments, ligatures, sutures, sponges, dressings, etc., are sterilized in elaborate sterilizers and by antiseptics; how air contamination is avoided by means of specially-constructed theatres, the wearing of sterilized garments by every one, and a moist atmosphere; and one is apt to think that, without any or all of these things, good surgery is impossible.

This would be wrong. Every measure mentioned is an aid to the achievement of ideal healing, and that should be the aim of every surgeon; but not one of them is essential. Lister's work has proved for all time, that safe and successful surgery requires no complicated or elaborate technique, no costly apparatus, no special buildings, if the principles of wound treatment discovered by him—how to keep away bacterial infection—are remembered, and intelligently acted upon. The only special requirements are: soft soap, a hard new nail-brush, washing soda, turpentine, methylated spirit, a very large pan, a good fire, clean basins, towels, abundant water, carbolic acid, and corrosive sublimate tabloids. The cleansing of patient, operator, and assistants, is then proceeded with.

The Skin of the Patient, covering the area to be operated on, is washed thoroughly with carbolic acid lotion (1-20) for five minutes; and during other preparations, a towel wrung out of the same lotion is left lying on it.

The Hands and Arms of operator, assistants, and nurses, are cleansed, first by washing not less than five minutes with soft soap and hot water (frequently changed), and a nail-brush, special care being taken to see that nails are short and clean; then comes rubbing with turpentine, and finally with methylated spirit, the nails and their roots again receiving particular attention. The last stage in the purification consists in soaking the hands and arms in 1-1000 corrosive sublimate lotion.

Meanwhile all the **instruments, dressings, towels, mops**, etc., required, have been placed in a pan filled with a solution of soda in water (one heaped tablespoonful to each quart), and boiled for ten minutes. If nothing else is available for ligatures

and sutures, linen thread, or silk, should be added to the contents of the pan.

A flat dish, thoroughly washed, and covered by a towel soaked in 1-20 carbolic lotion, is to be used as an instrument tray; scalded basins charged with carbolic and corrosive sublimate lotions, should be in readiness; and the area to be operated upon is surrounded and isolated, by sheets or towels wrung out of 1-20 carbolic lotion.

Before commencing, all hands and arms engaged are soaked again in 1-1000 corrosive sublimate lotion, which is to be washed off with 1-10,000 sublimate lotion, before making a wound. The reason for this is that all germicides are irritants, more or less vicious, and in imitating healing of the subcutaneous wound, the endeavour should be to avoid, as far as possible, contact of raw surfaces with them.

Boiled towels, in an emergency, serve very well as mops during the operation, and as a dressing after it. It is a good precaution to wring out of methylated spirit the towel next to the wound and used as a dressing.

If, during the progress of the operation, any of the hands engaged in it touch what is unsterilized, that hand must be regarded as unclean till a further process of purification has been gone through. The same rule applies to instruments, or anything else in connection with the wound. A single slip; a moment of forgetfulness; may make the difference between failure and success.

The dangers of air infection, though not to be disregarded, are slight. Movements in a dry, dusty room disturb the atmosphere, and floating particles of dust can carry organisms into the wound. Our floors are constantly sprinkled with corrosive lotion to prevent this.

The danger of talking into wounds is a very real one, for during conversation particles of saliva are ejected with considerable force, and carry with them the mouth organisms. If masks are not worn, talking should be avoided as far as possible, and mouths should be rinsed with antiseptics before each operation.

How is the continuous elastic pressure of the undivided skin of the subcutaneous wound to be imitated?

By careful Suture of the skin, and skilful Dressings.

The importance of properly applied pressure in surgery can scarcely be exaggerated. **Firm and careful Bandaging** over abundance of cotton-wool brings the wound surfaces into apposition, and hastens healing; it prevents exudation; lessens the need for drainage; and, by securing rest, minimises pain.

How is the minimum of interference with the wounded structures of the subcutaneous wound to be imitated?

By manipulations, as gentle as possible; by the avoidance of sluicing with antiseptics, the inclusion of large portions of tissue in ligatures, the use of ligatures when torsion will suffice, the use of unabsorbable when absorbable ligatures could be substituted, or the contact of drainage tubes or gauze when either is unnecessary.

How is Heat to be retained?

Insufficient attention has been bestowed upon the part played by heat in wound healing. Where do wounds heal as they do in the peritoneal cavity? In the mouth, wounds labour under great disadvantages. They are necessarily infected, and constantly irritated, by foreign bodies and unrest; but, because of the heat and moisture, they heal rapidly. The same moist heat, and elastic pressure, explain the success of Martin's bandage in the treatment of leg ulcers. The large wool-dressing advised supplies this requirement for our wounds.

Summary.—In an operation wound the aims of the surgeon are :—

The exclusion of organisms.

The infliction of as little damage to the tissues as possible.

The support of continuous elastic pressure.

The retention of heat.

A wound on which these principles have been carried out should heal under a single dressing and without pain or constitutional disturbance.

A more severe test of the truth of all this could scarcely be offered than the application of the method of amputation through the thigh for diabetic gangrene.

The last two patients on whom I have operated were :—

CASE 4.—Female, aged 67, admitted to a private hospital with septic diabetic gangrene of all the toes and spreading on to the dorsum of her left foot. Her general condition was very poor, as she was worn out with pain, loss of rest, and septic absorption. In addition to sugar, her urine contained albumin, and she was nearly blind from albuminuric retinitis.

Operation.—April 18, 1910. Wound dressed for first time April 30, 1910 (twelve days), and found to be entirely healed. Temperature and pulse normal the whole time.

CASE 5.—Female, aged 60, admitted to the Royal Victoria Infirmary for diabetic gangrene, involving the fourth toe and the sole of her left foot.

Operation.—August 25, 1910. Wound dressed for the second time on September 9, 1910 (eleven days). It was completely healed. (The day after operation her morning temperature was 101.5, though she made no complaint, and the leg was comfortable. Next day it was normal, and remained so for four days. Then, as it rose to 100°, the dressing was taken off to inspect the stump. This was perfect, and the dressing was reapplied.)

In both cases the operation was as follows :—

ANÆSTHETIC.—Morphia and atropine, chloroform, followed by ether.

1. The limb was elevated to a right angle, and rubbed upwards to stimulate the vasoconstrictors and empty it of venous blood.

2. A thick, broad indiarubber bandage was applied as a tourniquet, one layer of bandage over another, to the upper part of the thigh.

3. The limb was amputated by the circular method at the junction of the middle with the lower third of the thigh.

4. The femoral artery and vein, and any smaller vessels which could be demonstrated by squeezing the limb above, were caught, and ligatured with catgut.

5. First, the periosteum, then the muscles and subcutaneous fat, and finally the skin, were sutured in tiers with catgut over the end of the bone. The skin suture was subcuticular, and of catgut.

6. The dressing was applied, and the bandage firmly fixed.

7. The tourniquet was removed, and the patient sent to bed.

The Treatment of an Accidental Wound requires variation of the measures referred to, for, in every instance, it is essential to assume the introduction of micro-organisms, and to act with this knowledge.

As soon as hæmorrhage has been arrested, and the general condition of the patient has received attention, the wound should be covered with gauze, wrung out of 1–20 carbolic lotion; the skin around the wounded area should be thoroughly cleansed, as previously described; and the wound surrounded by protective antiseptic towels, as at an operation.

The history of the wound may be of the highest value. This should be carefully enquired for, and considered, as a guide to its probable extent and importance. The surgical ideal, however, is *to see*, or at least to feel, every part of the wound; and it is only when the patient's interests are likely to be endangered by the strict observance of such a useful rule, that excuse can be offered for neglect of it. It is unnecessary to emphasize the fact by relating the unexpected finds of foreign bodies in the wound, or the discovery of wholly unsuspected perforation through the skull; or into the peritoneal cavity; or into a large joint; because, serious as these are, their importance is overshadowed, in the majority of instances, by the probable introduction of infective organisms. It is often needful to extend the skin wound for exploration—especially in wounds of the scalp and of the abdominal wall—to discover penetration; and by this means, and the use of retractors, specula, and search-lights, the exploration of difficult wounds may usually be made complete.

The secret of good surgery is to leave as little as possible to chance. Where the presence of foreign bodies is possible, the preliminary use of Roentgen rays may offer invaluable aid (Fig. 86). The signs of nerve or tendon injury, or such gross indications as cerebral pulsations in the blood of a scalp wound; or the escape of omentum, faeces, or flatus from an abdominal wound; or the presence of other lesions, must not be overlooked before the treatment of the wound has been fully undertaken.



Fig. 86.—FOREIGN BODY EMBEDDED IN TISSUES OVER FRONT OF ELBOW JOINT.

The first object in such treatment is to remove all foreign bodies and dirt. A stream of hot (105° F.) normal saline (3j of salt to a pint of water) is run continuously into the wound during its exploration; and foreign bodies are to be removed, obvious dirt wiped away, and tissues so much damaged as to be clearly beyond recovery excised. It is well to remember, when dealing with wounds in conspicuous situations, that skin ingrained with gunpowder or coal dust never loses the stain unless all particles of these can be removed from it, and that the best way of doing this, if there is plenty of skin, is to excise the damaged portion.

THE ABDOMINAL AND PELVIC VISCERA 111

If the wound-cleansing appears to be satisfactory, an attempt should be made to complete restoration of all the parts—deep and superficial—to their normal relations, by catgut sutures for the deep, and fishing-gut for the superficial, parts. A small opening for drainage should be left in the skin wound, and the dressing may consist of sterile gauze, wrung out of 1-1000 spirit corrosive lotion, covered by an abundance of cotton-wool and retained by a firm bandage. If there is no pain, no rise in temperature, and no discharge—as should be the case if the cleansing has been successful—the dressing may safely be left for ten days, and the drainage tube need not be disturbed during this time. If there are either pain, elevation of temperature, or discharge, the wound should be inspected, and evidences of inflammation expected. Infection of the wound requires the removal of stitches, the opening up of the entire wounded area, gentle packing of it twice a day, from the bottom, with iodoform-formalin-glycerin gauze, and the use of Bier's apparatus, till the evidences of sepsis have all disappeared. Then it may be possible to draw granulating surfaces together.

If doubt is felt about the cleansing of the wound, it is best to leave it entirely open, for drainage, and gently packed from the bottom till all doubt is removed; then to make the best of bringing the parts together, when covered with healthy granulations.

For infected wounds of the extremities, Bier's bandage is most useful. It should be kept on for twenty-two hours of the twenty-four, and taken off for an hour night and morning. If properly applied, the limb below turns of a reddish-blue colour, the bandage produces some swelling, **relieves the pain**, and increases the discharge. The wound can be dressed with boric lint wrung out of hot boric lotion, covered with waterproof, and frequently changed.

THE ABDOMINAL AND PELVIC VISCERA.

Much confusion and bewilderment of thought have been occasioned by a wrong habit of regarding certain portions of the body as allocated to one or another division of regional surgery, with implied special conditions, and apart from a due consideration of general principles. In regard to abdominal and pelvic surgery, this tendency has been most noticeable.

Inflammation.—To any one who has considered the causes of acute inflammation and its terminations, it would be easy to understand the pathology of three of the most discussed diseases of the

present day—appendicitis, pancreatitis, and cholecystitis. Such an one would expect the cause to be infection with pyogenic organisms; and that the condition would end in either resolution; fibrosis; ulceration and abscess (including sloughing); or gangrene; these being the four terminations of inflammation.

With regard to chronic inflammation—which here is nearly always due to tubercle—the same rule of thought applies, for the difficulties in the abdomen are the same as are associated with tubercle elsewhere. There is the same tendency to infect lymphatic glands, and for them to soften and break down, or calcify; the same tendency to slow, obstinate ulceration; the same natural cure by fibrosis; the same mimicry of cancerous and sarcomatous growths, and ulcers; and the same need for remembering the specific underlying disease as a frequent cause of obscure or indefinite tumours or fluid effusions.

THE HOLLOW VISCERA.

All of these possess the power of contraction, by virtue of the unstriated muscle in their walls. The ordinary contractions of unstriated muscle are not perceived; they are painless. *The forcible contractions of unstriated muscle, on the other hand, cause the most severe pain that human beings can experience.* All the colics are examples; labour is a physiological demonstration of this fact.

The most usual *stimuli to forcible contraction*, are, the presence of a foreign body, plus inflammation; or rapidly increased tension. Excess of carbonic acid in the blood is also a predisposing cause of active contraction in unstriated muscle. During sleep the quantity of carbonic acid in the blood is increased; hence the frequency with which colic awakens the patient in the early hours of the night, when sleep is deepest.

After prolonged and intense effort, exhaustion of the muscular walls follows, and relief from the severe pain results, even though its cause be not removed. Instances of this in the urinary and gall-bladders, the intestines, the ureter, the bile-ducts, and the pregnant uterus, are not rare.

In all, after a variable period, if not relieved by art, the violent spasmodic pains gradually cease, the exhausted muscular walls no longer contract, and only an aching and tenderness are left.

All the hollow viscera react in a similar manner to stimuli. If the obstacle to be overcome causes a *partial obstruction*, their walls thicken from hypertrophy, and their cavities diminish. Examine the bladder, when a stricture of the urethra has been present for some

years (*Fig. 87.*) Its cavity is so small that frequent urination is the patient's chief complaint, its walls may be as thick as those of a uterus. In one patient on whom I operated, the bladder cavity was so small that I could only introduce the tip of my little finger into it, and its walls were so thick that on bimanual examination—a finger in the rectum and a hand pressing over the pubis—the bladder felt like a cricket ball.

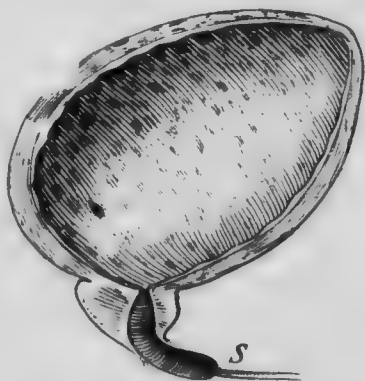


Fig. 87.—URINARY BLADDER, WITH STRICTURE OF URETHRA. Small cavity. Thick walls. Partial obstruction. (S) Stricture.



Fig. 88. GALL-BLADDER, WITH COMMON DUCT STONE NOT LARGE ENOUGH TO FILL DISTENDED COMMON DUCT. Partial obstruction. Small cavity. Thick walls.

In the gall-bladder the same thing has been observed, and described as Courvoisier's law. When the bile circulation is partially obstructed, as it is when a gall-stone is in the common duct, the gall-bladder cavity gradually decreases, its walls thicken and the contraction may be so great as to cause difficulty in finding that viscus (*Fig. 88*).

In some cases of pyloric stricture the cavity of the stomach becomes so small, and the walls of it so thick, that the whole organ comes to resemble a thickened intestine (*Fig. 89*).



Fig. 89. STOMACH, WITH STRICTURE OF PYLORUS. Small cavity. Thick walls. Partial obstruction.

If the obstacle to be overcome prove invincible (*total obstruction*), the muscular walls cease to contract; the violent pains abate, paresis of the muscular coat occurs, and is followed by passive distention of the viscus, and perhaps at a later period by degeneration of the unstriated muscle.

Patients not infrequently come to the Infirmary with a urinary bladder distended to the umbilicus, complaining only that "they cannot keep their water." The painful period has been succeeded by relief, and the bladder distention by overflow (*Fig. 90.*)



FIG. 90. — URINARY BLADDER, WITH ENLARGED PROSTATE.
Large cavity. Thin walls. Complete obstruction.

Hydrops of the gall-bladder is not uncommon, and is usually due to a large gall-stone firmly impacted in its neck, and distention of the cavity by secretion from its mucous lining. The history, generally, is that after a violent attack of pain, of some hours' duration, relief gradually came, and a tender "lump" followed some days later (the distended gall-bladder).

If the common bile-duct is completely blocked by a growth in it, or in the head of the pancreas, there is painless distention of the gall-bladder (*Fig. 91*). To the combination of jaundice



FIG. 91. — GALL-BLADDER, WITH ENLARGED HEAD OF PANCREAS AND DISTENDED COMMON DUCT.
Large cavity. Thin walls. Complete obstruction.

with a distended gall-bladder, high diagnostic significance is attached; for it is usually due to complete obstruction of the common bile-duct from malignant disease.

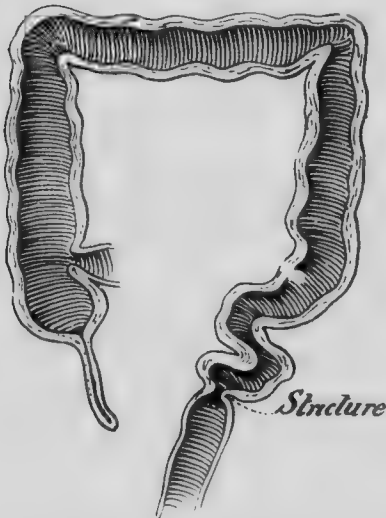


FIG. 92. -CECUM AND COLON, WITH STRICTURE OF SIGMOID.
Small cavity. Thick walls. Partial obstruction.

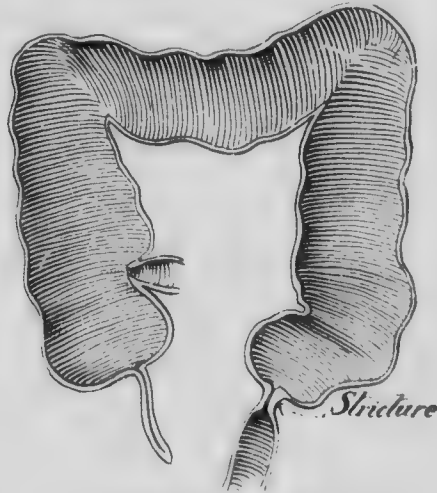


FIG. 93. CECUM AND COLON, WITH TIGHT STRICTURE OF SIGMOID.
Large cavity. Thin walls. Complete obstruction.

Painless distention of the cæcum occasionally follows a block of the sigmoid flexure (*Figs. 92 and 93*); enormous painless distention

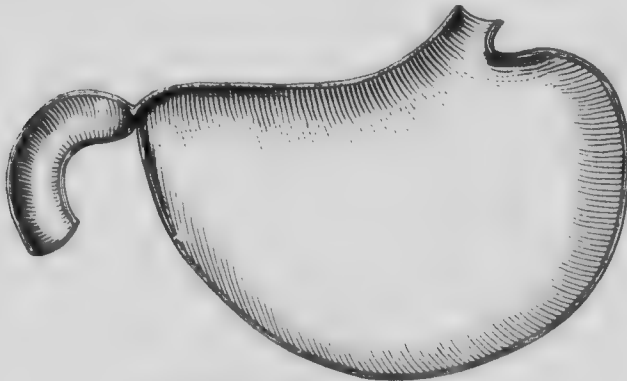


FIG. 94. -STOMACH, WITH STRICTURE OF PYLORUS.
Large cavity. Thin walls. Obstruction nearly complete.

of the stomach, an obstructed pylorus (*Fig. 94*); hydrosalpinx and hydrops of the vermiform appendix may follow a limited occlusion.

If active inflammation is superadded to obstruction, the intra-visceral tension may become so acute that the circulation is interfered

with, and partial or total gangrene of the involved viscus, to be followed by its rupture, will take place. It must be noted that not every form of gangrene is due to this mechanical cause. As in the body elsewhere, there are instances of infective gangrene, due to virulent inflammation following infection by organisms; but here, as elsewhere, these are rare, and are marked by their rapid spread, and their absence of relation to the blood-supply. The conditions which we are considering are due to mechanical interference, and the gangrene commences at a spot farthest from the source of the vascular supply; for example, in the gall-bladder it is first observed at the fundus (Fig. 95); in the urinary

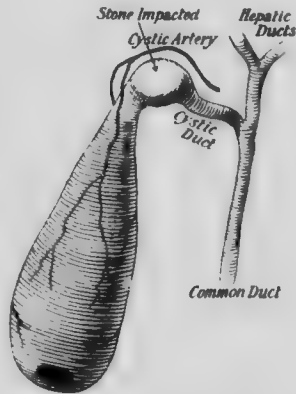


Fig. 95.—DIAGRAM OF GALL-BLADDER TO ILLUSTRATE TENSION GANGRENE.

bladder it is first observed at the fundus (Fig. 95); in the urinary

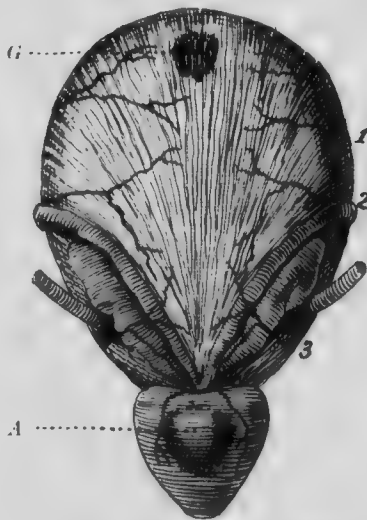


Fig. 96.—TENSION GANGRENE OF BLADDER.
(A) Prostatic abscess. (G) Gangrene. (1) Superior vesical arteries. (2) Mid-vesical arteries. (3) Inferior vesical arteries. The diagram is from a specimen removed from a young man who had retention of three days' duration from acute gonorrhoeal prostatitis and excessive whisky drinking.



Fig. 97.—DIAGRAM OF APPENDIX TO ILLUSTRATE TENSION GANGRENE.

bladder at the superior portion of the posterior wall (Fig. 96); in the vermiform appendix (Fig. 97) and the small intestine (Fig. 98), at a point opposite the mesentery; in the cæcum, in the neighbourhood of its anterior longitudinal band (Fig. 99). In each instance it appears as a rounded or oval patch, which steadily spreads.

All muscular tubes, such as the intestine, urethra, bile-duct, and ureter, act in a similar way when a foreign body attempts to pass through them. *A relatively small body such as a stone of moderate size may set up violent spasmodic contractions, and be so tightly gripped as to cause, temporarily, complete obstruction.*

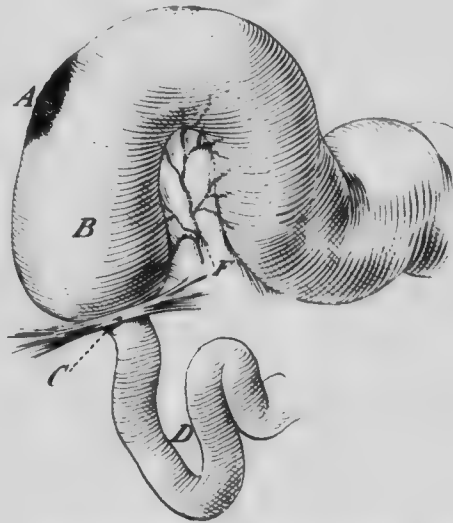


Fig. 98. — ACUTE INTESTINAL OBSTRUCTION OF TWO DAYS' DURATION.

(A) Gangrenous patch. (B) Small intestine distended. (C) Constricting band. (D) Collapsed intestine. (F) Mesenteric vessels.

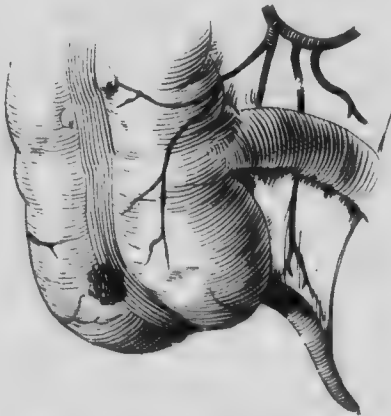


FIG. 99. DIAGRAM TO ILLUSTRATE TENSION GANGRENE IN THE CÆCUM.

At a later stage, the walls of the muscular tube recede from the foreign body, and active dilatation follows.

When a large gall-stone has found its way by ulceration through the gall-bladder into the small intestine, it is likely to cause intestinal obstruction. The attack is characterized by starting with violence; ending in relief; but followed by recurrence, probably on several occasions, before the stone escapes, or is removed by operation. The explanation is, that the stone, gripped at some stage

of its progress, causes intestinal obstruction; relaxation round the

stone relieves this, and the stone passes on until either further arrest with recurrence of symptoms, or its escape from the intestine, occurs. A small stone arrested in the urethra may cause temporary retention



Fig. 100.—SIZE OF GALL-STONE WHICH CAUSED JAUNDICE AND DEATH BY OCCLUDING THE COMMON BILE-DUCT.

The gall-bladder and common duct had been cleared (?) by operation two weeks previously, and this stone was only found post mortem. The patient whilst convalescent was seized with a severe attack of biliary colic. Next day was jaundiced, and died suddenly, syncopal, three days later.

of urine; in the ureter, intermittent hydronephrosis; and in the common bile-duct, intermittent jaundice (Fig. 100); because the small stone, and spasmodic contraction of the muscular tubes, cause a temporary block. So soon as the spasm relaxes, the condition in each is relieved. A large stone is unlikely to cause complete blocking of any of these muscular tubes, on account of their active dilatation round the foreign body. In

the presence of a ureter stone, the ureter may reach the size of the small intestine; the enormously dilated common bile-duct, with a stone in it, has frequently been mistaken for the duodenum (Fig. 102).

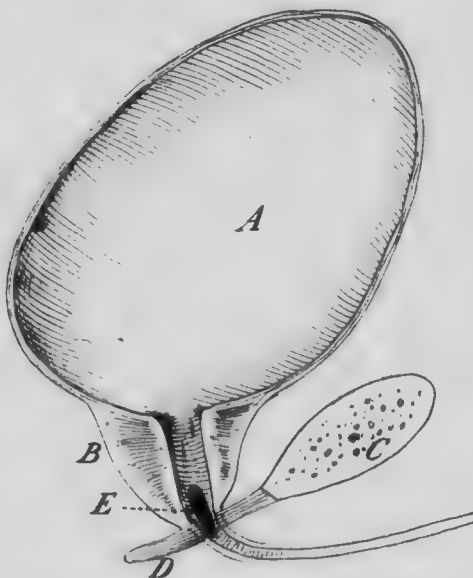


Fig. 101.—URINARY BLADDER RETENTION FROM STONE IN URETHRA.

(A) Bladder. (B) Prostate. (C) Symphysis pubis. (D) Triangular ligament. (E) Stone impacted in urethra. When of this size it may cause complete obstruction.

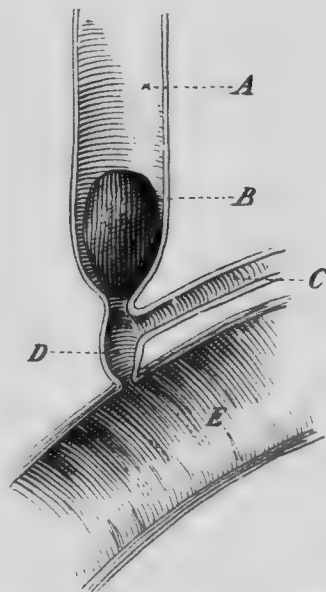


Fig. 102.—NOT UNCOMMON SIZE OF COMMON BILE-DUCT WITH GALL-STONE IN IT.

(A) Bile-duct. (B) Gall-stone. (C) Pancreatic duct. (D) Ampulla. (E) Duodenum. (Drawing two-thirds natural size.)

Diverticula and Sacculi.—Confusion has arisen between these conditions, etiologically distinct, because of resemblances in their pathology.

The *diverticula* are of congenital origin. All coats of the intestine enter into their composition. All have a special vascular supply of their own. They are seldom, if ever, multiple, and are found at any age. The vermiform appendix is representative of this type in the normal subject. Meckel's diverticulum, due to arrested involution of the omphalo-mesenteric duct, is the most common abnormal diverticulum (Fig. 103). Others

are associated with small supernumerary pancreatic outgrowths at any part of the gastro-intestinal tract, and traction diverticula have also been described. As these latter are due to the mechanical drag of a small adhesion, they should be classified by themselves.

Sacculi differ from diverticula in that they are never of congenital origin, and have consequently not been found in youth; are associated with obstruction of the outlet, and weakness of the wall, of the affected viscus; are multiple; are thin-walled, because they are mostly hernias of the mucous coat through the muscular coat; are rounded in shape; do not

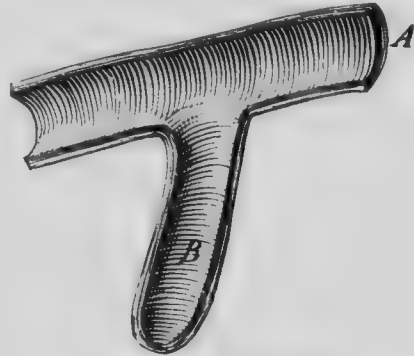


Fig. 103.—MECKEL'S DIVERTICULUM.
(A) Small intestine. (B) Diverticulum—wall formed by all the coats of the intestine. *Diverticula are congenital.*

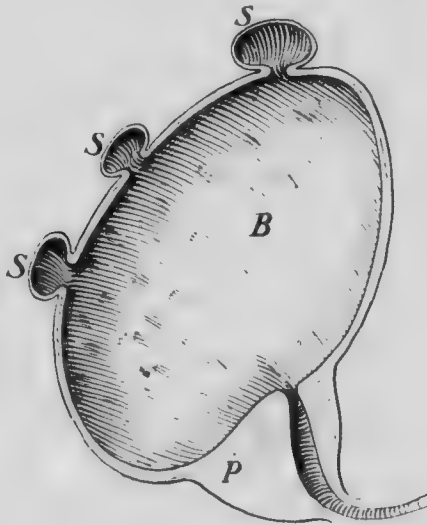


Fig. 104.—SACculi OF BLADDER.
(B) Bladder. (P) Prostate. (S) Sacculi.

attain to very large size; and are practically limited to advanced life. In the urinary bladder (Fig. 104), all parts of the gastro-intestinal

tract (*Fig. 105*), the gall-bladder (*Fig. 106*), the vermiform appendix (*Fig. 107*), and Fallopian tubes, similar swellings have been described;

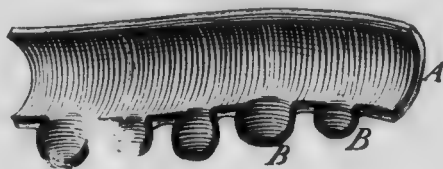


Fig. 105.—MULTIPLE SACCULI.

(A) Lumen of intestine. (B) Walls of sacculi formed mainly by mucous membrane (and peritonæum). Sacculi are acquired.

Sacculi in the urinary bladder and in the colon—especially in the sigmoid flexure, where they are most common—may be of the greatest surgical importance, for they are subject to the same pathological changes that occur in the vermiform appendix and other diverticula. All of them may harbour concretions, and all of them are liable to attacks of inflammation with the ordinary terminations. It is

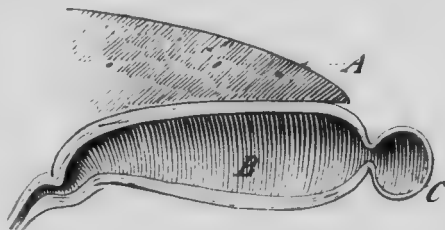


Fig. 106.—SACCULI OF GALL-BLADDER.

(A) Edge of liver. (B) Gall-bladder. (C) Saccule.

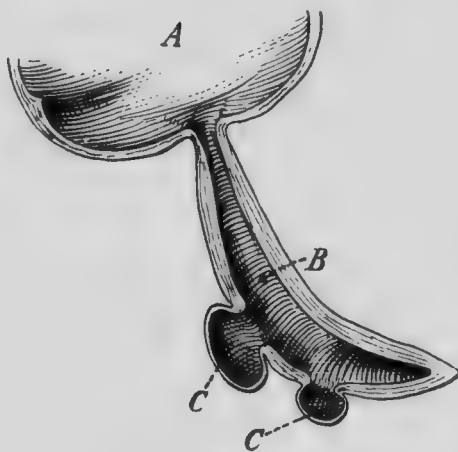


Fig. 107.—SACCULI OF APPENDIX.

(A) Caecum. (B) Appendix. (C) Sacculi.

indeed, it is safe to say that they will be found, if sought for, in any of the hollow muscular-coated viscera. It seems probable that some of the so-called diverticula of the oesophagus are true diverticula; but some of them are sacculi; and the distinction should be made here as elsewhere.

therefore possible to find a Meckel's diverticulum with a faecal ball, or a calculus, in it. It is also possible to find it either fibrosed and adherent, or ulcerated, with perforations in it and an abscess round, or totally gangrenous, as in appendicitis. Similar changes occur in the bladder and colon altered by sacculi, so that it is possible to have on the left side, as a consequence of sacculitis of the sigmoid, gangrenous perforation with peritonitis;

ulceration and perforation with left iliac abscess; or, inflammatory thickening and fibrosis, so closely resembling a malignant growth of the affected bowel, that after examination by macroscopic section alone, a diagnosis may be impossible.

Calculi.—Though calculi may be found in various parts of the body, and in different organs (blood-vessels, brain, salivary glands), their favourite site is in these abdominal and pelvic viscera, which are hollow, and are lined by mucous membrane. Many of them are associated with infection of the mucous lining by micro-organisms, but all of them require other unknown conditions for their development.

The ordinary calculus—not the variety associated with active infection—may be regarded as a foreign body, for it behaves as such. Like aseptic foreign bodies, when undisturbed and quietly resting, calculi cause no serious trouble, and few, if any, symptoms. Like foreign bodies, they weaken the normal resistance of the surrounding tissues, and predispose to infection. As in the case of foreign bodies, when once infection has occurred, it is difficult to get rid of until the calculus has been extruded or removed.

Bladder calculi have grown to a large size without causing urgent symptoms or serious trouble. The symptoms described as characteristic of vesical calculus are those of calculus and cystitis. Violent contractions of the muscular bladder-wall then follow its increased sensibility and the stimulation of its mucous membrane.

Renal calculi may be present for years without causing trouble. The symptoms described as characteristic of renal calculus are either due to increased renal tension, or to superadded inflammation. The most typical attacks of renal colic are due to increased renal tension from acute hydronephrosis. This may be due to a movable calculus falling into and blocking the kidney pelvis, or to a stone passing down the ureter, and causing blockage through spasm. The attack may be imitated by distending the kidney pelvis by fluid injection through a ureter catheter; or by any other condition capable of causing acute obstruction to the escape of urine from the kidney (hydatid cysts, tuberculous debris, blood-clots, ureter kinks, etc.).

Another ordinary cause of the symptoms described as typical of renal calculus, is superadded inflammation of the mucous membrane of the kidney pelvis (pyelitis) and ureter. A stone, which does not cause obstruction, may lie in the kidney pelvis for years, without causing trouble (*Fig. 108*); but as soon as the sensibility of the mucous membrane of the pelvis and ureter are increased by inflammation, violent contractions of their muscular coats are set up in endeavours made to extrude the stone.

Many renal calculi have been passed without any knowledge of their presence, or descent, until they stuck in the urethra, or attracted attention by the noise of their escape. A very usual evidence of kidney calculus, and the first sign of trouble from it, is a renal abscess. On opening this, a stone, or stones, which have taken years to form, are found, with a past history that conveys no serious suggestion.



Fig. 108. — RENAL CALCULI.

Biliary calculi may be present in the gall-bladder, or even in the bile ducts, for long periods of time, and cause no serious trouble. The "attacks of biliary colic," said to be characteristic of gall-stones, are due to violent contractions of the muscular coats of the gall-bladder or bile-ducts. These are produced, either by increased tension, or by increased sensibility from inflammation of the mucous

lining. Typical biliary colic will follow distention of the gall-bladder with fluid from a syringe; it will also follow the discharge of blood-clot from an inflamed gall-bladder which has been emptied of stones and rotated closed into the abdomen.

The largest biliary calculi—and in this they resemble bladder and renal stones—are those in which the "characteristic symptoms" are most likely to be absent. Biliary calculi, the size of hens' eggs, have been slowly extruded by ulceration into the intestine, and the first evidence of illness has been an attack of acute intestinal obstruction. The gall-stone, whilst in the gall-bladder, caused no trouble. Like all the other calculi, gall-stones can make a painless escape.

PROGNOSIS.—In all of them the symptoms of their presence are the result of calculus, plus complications likely to produce progressive mischief, and unlikely to terminate in a satisfactory natural cure.

TREATMENT.—The treatment in all of them is to remove the stones before further complications and more damage have been inflicted.

INVERSIONS AND TORSIONS.

Inversions.—The tendency to turn inside-out seems common to all of the hollow viscera, for it has already been recorded of so many of them. In the intestines it is described as intussusception,

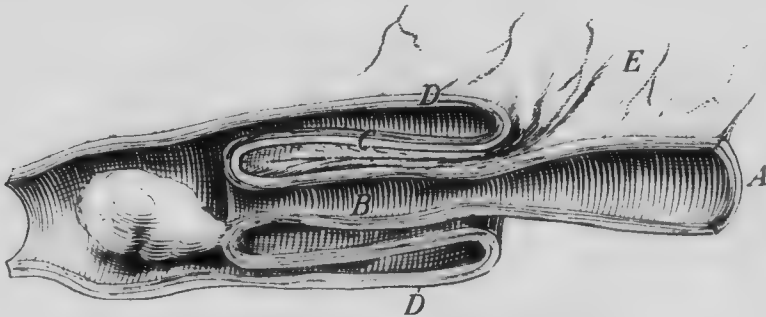


FIG. 109. - INTUSSUSCEPTION DUE TO POLYPU S.

(A) Proximal intestine. (B) Entering layer. (C) Returning layer. (D) Ensheathing layer. (E) Mesentery.

inversion of the appendix, and prolapse of the rectum; in the uterus as inversion; the inverted ureter has found its way out of the female urethra; and the vagina and the urethra may both be prolapsed.

The cause in the majority of cases is unknown, but it seems probable that the prolapse is of an abnormally active portion above, through an abnormally passive part below.

Attempts to extrude a tumour in the intestine (*Fig. 109*),

and in the uterus (*Fig. 110*), have given rise to the condition—Polypi in the intestines; Fibroids in the uterus.

In all of them it may be *acute* and serious in results, or *chronic* and causing no grave symptoms; and in all, this is determined by the *condition of the vascular supply of the prolapsed portion*. If the part inverted is so constricted by the area through which it passes, as to interfere with the return of its venous blood, the serious



Fig. 110.—CHRONIC INVERSION OF THE UTERUS WITH FIBROID TUMOUR.

(A) Vagina. (B) Fibroid polypus. (C) Cervix. (D) Inverted fundus uteri. (E) Cup-shaped hollow. (F) Fallopian tube.

symptoms and *signs of strangulation*—pain and collapse, thrombosis, ulceration, sloughing, gangrene—result. If, on the other hand, there is no obstructed circulation, the symptoms will only be those of a mechanical disturbance, and the course chronic.

Torsions.—Twists are common to nearly all of the abdominal viscera. The intestine (*Fig. 111*), (volvulus), stomach, gall-bladder, appendix, kidney, spleen, omentum, uterus (pregnant and fibroid) (*Fig. 112*), distended Fallopian tubes (hydrosalpinx, pyosalpinx,



Fig. 111.—VOLVULUS OF SIGMOID FLEXURE OF COLON.

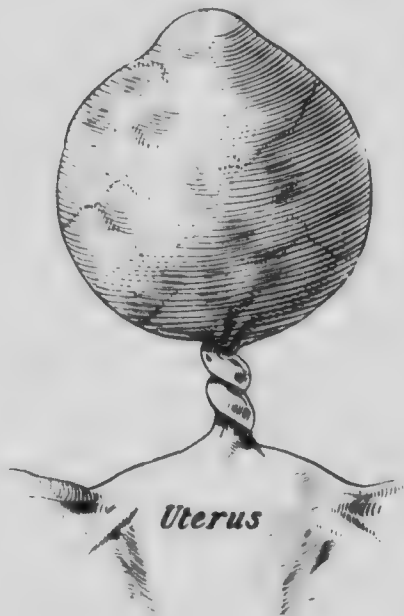


Fig. 112.—VOLVULUS OF SUBPERITONEAL FIBROID.

ectopic gestation), ovaries, and testes, are each liable to such accident.

The sudden attack; the mystery of its onset; the associated dangers and pain; and the amenability of the condition to surgical treatment, have made this subject one of special interest.

Whatever organ the twist involves, and whether viewed in reference to *etiology, pathology, symptoms, diagnosis, prognosis, or treatment, all cases have many points in common.*

In order to twist, the organ must have a pedicle, congenital or acquired; and the longer the better. It must have space to turn in, and a shape which will allow of rotation.

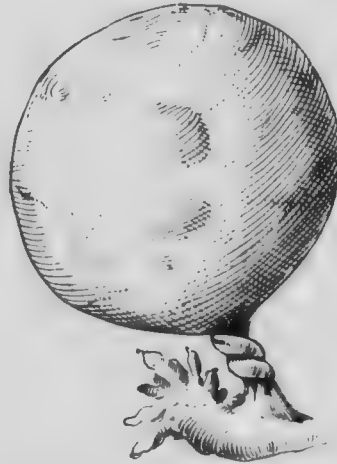


FIG. 111.—VOLVULUS OF OVARIAN CYST.
The Fallopian tube is represented in the diagram as free. It is usually involved.

Ovarian Tumours with Torsion of the Pedicle.—No other movable body answers to these requirements as does an ovarian tumour; and accordingly, the majority of torsions are associated with ovarian tumours (*Fig 113*).

The presence of a second ovarian tumour, or of a pregnant uterus, predisposes to twisting; so does the fact that the tumour is a dermoid. The probable explanation is, that one swelling helps to roll the other over, and that dermoid tumours, being lighter than ordinary ovarian tumours, are more easily rotated.

Volvulus of the Intestine.—

Next to ovarian tumours the intestine is most liable to twists; but volvulus of the intestine, though not extremely rare, has, judging by current diagnosis, its frequency exaggerated.

Normal intestines do not meet two of the requirements necessary for the production of a volvulus—a pedicle, and a shape which will allow of rotation—but two recognized conditions may permit of this. The first is a congenital or acquired defect in the intestinal attachments allowing of wide mobility; and the second, one which produces an artificial pedicle. In the first type, the volvulus should be regarded as *primary*; in the other as *secondary*.

Of *primary* volvulus there are three well-known varieties. Two of them, the most common, involve the cæcum, and are described as

1. Complete volvulus.

2. Partial volvulus.

In the complete variety (*Fig. 114*),* the torsion occurs round the superior mesenteric artery as an axis; in the partial form, the ileocolic artery forms the axis of rotation. In both, the cæcum by its rounded shape predisposes to volvulus, and in both a congenital absence of the normal fixation-bars of the cæcum and colon, with arrested development and elongation of the mesentery, allow of that pedicle-formation and free movement which are essential.

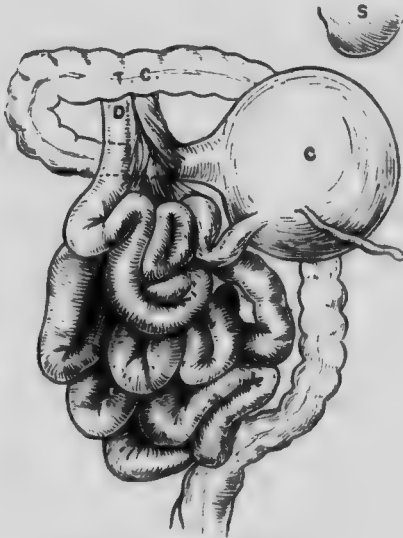


Fig. 114. COMPLETE VOLVULUS.

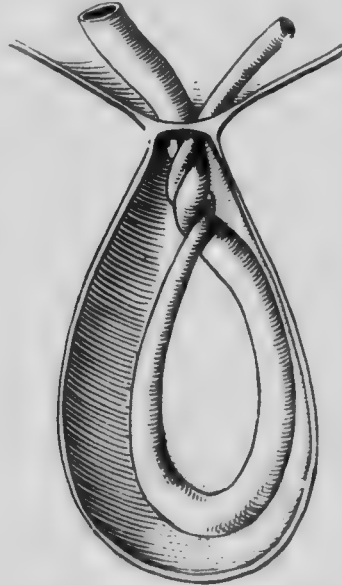


Fig. 115. VOLVULUS IN A HERNIAL SAC.
The volvulus may involve the intestine in the abdomen and not that in the hernial sac: but in either case the pedicle is formed by the neck of the sac.

In the first, the distended cæcum is found near the spleen; in the second, usually in the pelvis.

3. The third variety concerns the sigmoid loop, and is always accompanied by distended bowel and marked elongation of the mesentery, either congenital or acquired.

Secondary volvulus is the more common form, and deserves wider recognition than it has yet received, because it is often a dangerous addition to an already serious lesion. The necessary pedicle may be produced by the constriction of the neck of a hernial sac (*Fig. 115*);

* From *Medical Annual*, 1908

by the pressure of a band on an intestinal loop (*Fig. 116*); or by moderate torsion on an intestinal loop already fixed by an adhesion

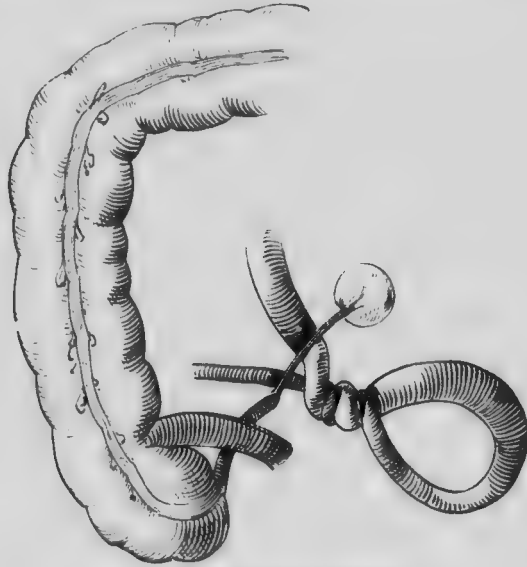


Fig. 116. — VOLVULUS OF INTESTINE.
Under a band-adhesion stretching from the appendix.

or by a hernia (*Figs. 115 and 117*); so that the acute symptoms associated with either a hernia, a band, or intestinal adhesions, may



Fig. 117. — VOLVULUS OF SMALL INTESTINE.
Meckel's diverticulum and band.

all be due to a secondary volvulus, the hernia, band, or intestinal adhesion acting only as the predisposing cause.

The Causes of Torsion have been largely discussed, but there is little real knowledge of them. Chronic constipation; congenital or acquired defects in attachment; and, in the case of ovarian cysts, alternate distention and collapse of the sigmoid flexure and urinary bladder, movements of the abdominal wall, and peristaltic movements of the intestines, have been specially mentioned. A second tumour, ovarian or uterine, is an aid, so is the enlargement (space to turn in) resulting from recent pregnancy. It is possible that in some cases the omentum, recognizing the tumour as an intruder, tries to hustle it, and thus starts the twist.

In the great majority of cases the twist is from left to right. The reason for this has been widely disputed; but it should be remembered that a left to right twist is an inherent physiological trait, which reveals itself, amongst other instances, in the heart's beat, in the development of the gastro-intestinal tract, and in the contractions of the uterus during labour.

The only exception to this, and it is apparent only, is in the complete volvulus. In the course of development the cæcum moves from the middle line to the right, that is, from left to right. In the rotation due to complete volvulus, the cæcum is generally found lying on the left side, near the spleen, and has passed over from right to left; but this is obviously the result of the same movement which started from left to right.

The pathological changes that occur in connection with twists are in all cases similar, and are due to interference with the local circulation. If recognized early, the twist can be undone. Later changes, due to inflammation and matting of the surrounding tissues, may obscure the cause of the condition.

The first change is an engorgement of the veins of the organ twisted; with an effusion of blood-stained serum into the peritoneal cavity, or into the tunica vaginalis if the case is testicular.* Then follow extravasation of blood into the affected organ, total arrest of the circulation, and gangrene. Afterwards, the dead tissue acts as a foreign body, and peritonitis may ensue. If so, organisms from the surrounding intestines penetrate the dead or dying tissues, and an abdominal abscess results. Or, in the case of small ovarian cysts, and those damaged gradually by a series of twists, a new circulation can be established through new vessels formed in omental adhesions, and, following on such a history, an ovarian tumour may then be found growing in, and from, the omentum. More rarely still, entire absorption of the gangrenous mass may take place.

* So far as I know, torsion of the testicle only occurs when an arrest of development is present.

SYMPTOMS.

In all cases, pain is an urgent and striking symptom; and severe abdominal pain deserves more than a passing notice, for it may be of considerable use in diagnosis.

Abdominal Pain.—All of the internal viscera are insensitive to ordinary painful stimuli. The stomach, intestine, kidney, liver, testis, uterus, and ovaries, can be cut, crushed, sewed, or burned without producing pain, in the conscious patient; but the parietal peritoneum is exquisitely sensitive to all such stimuli; the mesentery to dragging; and the viscera to internal tension. Another cause of severe abdominal pain is the forcible contraction, from any cause, of unstriated muscle.

The following four causes all require consideration in abdominal diagnosis, viz.:—

1. Irritation of the parietal peritoneum.
2. Dragging of the mesentery.
3. Intravisceral tension.
4. Forcible contraction of unstriated muscle.

Irritation of the parietal peritoneum from disease is usually the result of extravasation into the peritoneal cavity. Immediately on the extravasation of the contents of the stomach—through a gastric ulcer, for example—the patient complains of intense pain, diffuse, burning, and “deadly.”

Immediately the mesentery of a portion of gut, or the pedicle of an ovarian tumour, is tightly twisted, the patient feels “agonizing” pain, and becomes sick and collapsed.

On injection of the bladder, kidney, pelvis or intestine with water, so soon as distention of the viscus is produced, pain develops.

All of the spasmodic pains, “colics,” are due to forcible contraction of the unstriated muscular coats of the hollow viscera.

In all acute cases of *torsion*, the attack commences suddenly, with severe pain, increasing steadily in intensity, and accompanied by vomiting, by the symptoms of collapse (signs of strangulation), by suggestive tenderness on pressure over the involved organ, and increase in size of a tumour previously recognized.

In all cases, the attack may steadily progress to a fatal issue, and in well-pronounced instances this is the rule. The majority, however, give a history of one or many previous attacks, which have either been recovered from very rapidly, or else somewhat slowly. In the former, the twist had become undone; in the latter, the circulation had been successful in the struggle to relieve itself; but a permanent twist remained.

Testicle, bowel, omental, and ovarian cases, in which several twists had occurred, have come under our notice ; in these, the last attack had been preceded by many of a similar character. It was clear that, though several old-standing twists were present, the last was *the* cause of serious mischief. No dangerous result may follow even five or six twists, the result depends on the effect on the local circulation. Half a twist, with a short broad pedicle, may do more damage to the circulation, and be more serious in its results, than half a dozen when the pedicle is long and narrow.

The treatment of all internal twists is the same, namely, by operation as early as possible.

STRANGULATION.

The clinical and pathological effects of strangulation in hernia have been recognized and taught for many years. The most serious results from inversions and torsions are *due to the same cause*, that is, interference with the circulation from strangulation of the blood-vessels.

IDIOPATHIC DILATATION.

The œsophagus, the stomach and small intestine, the colon and rectum, the urinary bladder, the uterus, the gall-bladder and common bile-duct, and the ureters, have all been found enormously dilated, and the most careful search has failed to reveal any sufficient cause.

The condition may be *acute* or *chronic*.

In chronic cases the muscular coat of the involved viscus may be enormously hypertrophied.

œsophagus.—In the œsophagus, the chronic variety is of greatest interest and importance. It is described as cardiospasm. One patient of mine could retain more than one pint of food in his œsophagus for several hours (*Fig. 118*).

Stomach.—In the stomach, the acute variety is the most important. In the course of typhoid fever; after labour; after the application of Sayre's jacket for Pott's disease; but above all, after abdominal operations, the stomach may dilate to such an extent as to appear, on post-mortem examination, to fill the abdominal cavity (*Fig. 119*); and the patient soon dies unless the condition can be relieved. On passing a stomach-tube, a quantity—often several pints—of foul greenish stomach contents escapes, and the relief is immediate. This condition is so often met with after abdominal operations, that suspicion of it should be the first entertained for a patient not doing well. If extreme thirst,

sickness, and epigastric distention are present, the stomach should be washed out without delay; and if the diagnosis is confirmed by this, the washing must be repeated three or four times a day till all danger has passed.

Small Intestine.—In the small intestine, it is chiefly of importance when of the acute variety, and is known as paralytic ileus. This has occurred in Bright's disease, diabetes; and after labour and other

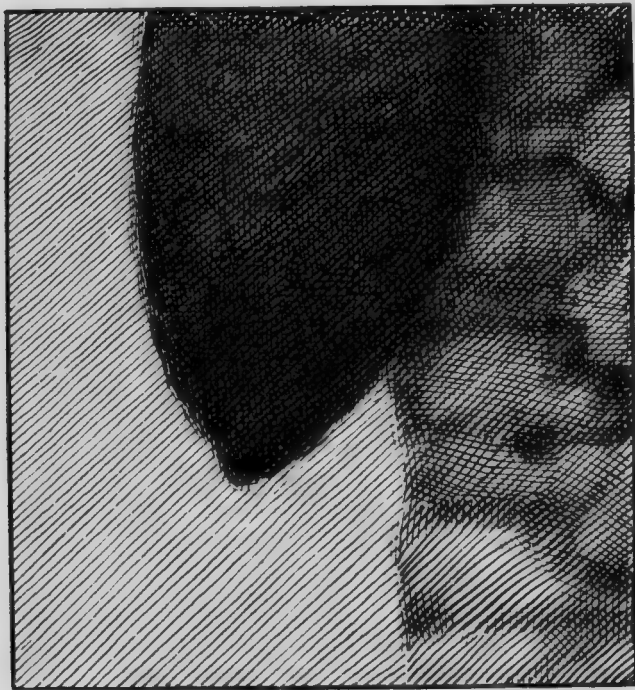


Fig. 118.—IDIOPATHIC DILATATION OF THE ESOPHAGUS.

Drawn from a skiagraph of a case of cardiospasm. The oesophagus, distended with bismuth porridge, is seen lying in front of the spine.

injuries; but is chiefly of interest as following abdominal operations. The great majority described as such, and following these operations, result from septic peritonitis, and have no connection with true paralytic ileus, which is very rare. The symptoms, unlike those due to peritonitis, do not usually commence till after the third day, and the first to appear is painless distention. Pain is not a feature till forcible efforts are made to obtain an action of the bowels, and this may cause pain, vomiting, and increase of distention, but

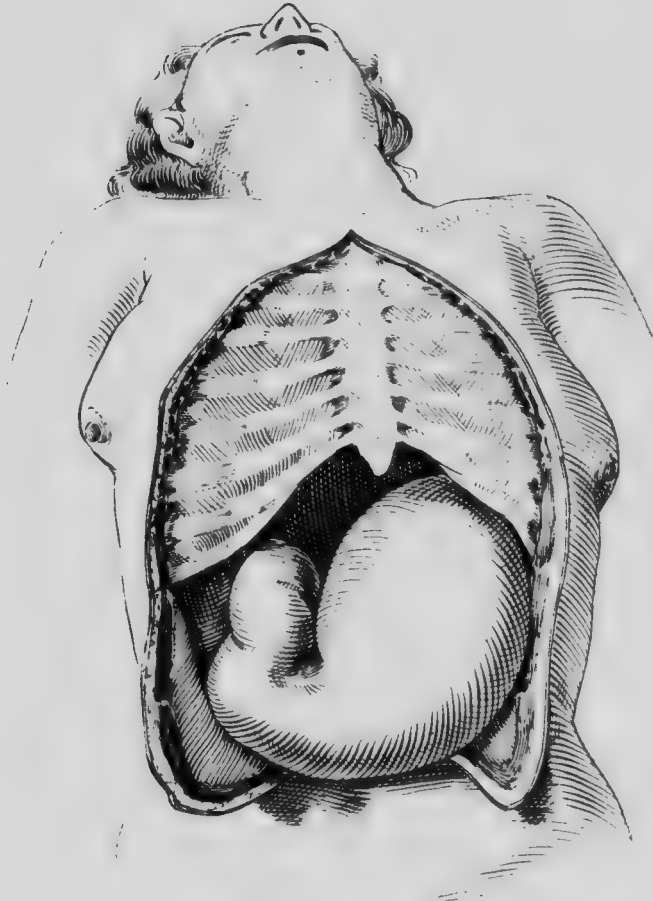


Fig. 119.—ACUTE DILATATION OF STOMACH.
Diagram of post-mortem appearance.

In this patient the duodenum was dilated also. This condition has been described as gastro-mesenteric ileus, and attributed to mechanical obstruction by traction of the mesentery, containing the superior mesenteric artery. Descent of the small intestine into the pelvis converts the mesentery into a band, and blocks the duodenal termination. That this is not a correct view is proved by the fact that the dilatation may affect the stomach only, may stop at any part of the duodenum, or even extend for a yard or more down the jejunum.

not the desired relief. In spite of all remedies, even enterostomy, the bowels will not act; and in from seven to fourteen days the patient dies, chiefly as the result of intestinal distention and heart failure.

Colon.—In the colon, the chronic variety (Hirschsprung's disease) is of the greatest importance (*Fig. 120*).

The sigmoid flexure is its favourite site; but all parts of the colon may be affected by it. The sigmoid colon, enormously thickened and dilated, may be loaded with pounds of faecal matter, and sufficiently distended to occupy the greater part of a much enlarged



Fig. 120.—IDIOPATHIC DILATATION OF THE COLON.

Case of a child, *et.* 3. Symptoms of chronic constipation since birth. Note the distended coils of intestine, and emaciation.

abdomen. The condition commences in childhood; and constipation may reach such extremes that it is necessary to empty the lower bowel by manipulation from time to time. An anæsthetic is seldom required, as these patients are so tolerant as to suggest that they are considerably less sensitive than ordinary individuals, and to support the belief that their condition is, in some manner, related to nerve defects.

Rectum.—In the rectum the condition is described as "ballooning;" and great importance was formerly attached to this, as a

sign of obstruction in the bowel above. It is now known to be produced by a number of other conditions, and less importance is therefore attached to it now.

Urinary Bladder.—Acute dilatation is one of the most common sequelæ of operations. Of the chronic form, my personal experience is limited to two cases. In one, the dilated bladder was that of a boy, on whom I performed sigmoid colostomy, for chronic idiopathic dilatation of the colon. The other was a boy, aged 9, who was admitted to the Infirmary under my care in 1909, for an abdominal swelling. He always had a prominent abdomen; but four years ago it began to get larger. Two years ago he had several fits, and the abdomen got larger still. He had been thirsty and tired, and passed much urine. He often vomited. His eyelids latterly had been a little swollen in the morning. There was no œdema of the legs. The patient was a fairly healthy-looking boy. His abdomen measured $27\frac{1}{2}$ inches at the level of the umbilicus. The physical signs were those of a cystic tumour occupying the larger part of the abdomen, and causing marked distention (*Fig. 121*). A catheter was passed, and an enormous quantity (not measured) of urine was drawn off. It was acid; specific gravity 1005. Albumin and blood-casts present. No sugar. Urea 5 grains per ounce. A catheter was tied into the bladder, and left for several days. He afterwards passed urine naturally, but the bladder again gradually distended, and a catheter was passed on several occasions, drawing off from 90 to 114 ounces of urine. Active



Fig. 121.—IDIOPATHIC DILATATION OF THE BLADDER.

contractions of the bladder wall could be seen and felt whilst it was emptying. The passage of a catheter appeared to cause him no discomfort; and the bladder distention so little inconvenience, that he would allow twenty-four hours to pass before asking to micturate.

Both cases were characterized by the presence of intermittent abdominal enlargement, due to enormously distended bladders, which gave rise to no pain, and did not seem to affect the health seriously. Neither patient resented, or appeared to feel any discomfort during, the passage of a catheter.

Uterus.—A rare condition, undescribed in gynaecological treatises, occurs in the uterus. It is usually discovered by accident, during a routine examination, and may be verified by an operation done under a mistaken diagnosis. The uterus enlarges (in one of my cases to the size of a three months' pregnancy, its cavity measuring six inches), and, in consequence of its weight and the softness of its walls, is apt to retroflex; then the soft enlarged fundus in Douglas's pouch is mistaken, before operation, for a cyst. After it, for a pregnancy. The enlargement may remain permanent without symptoms, and eventually disappear.

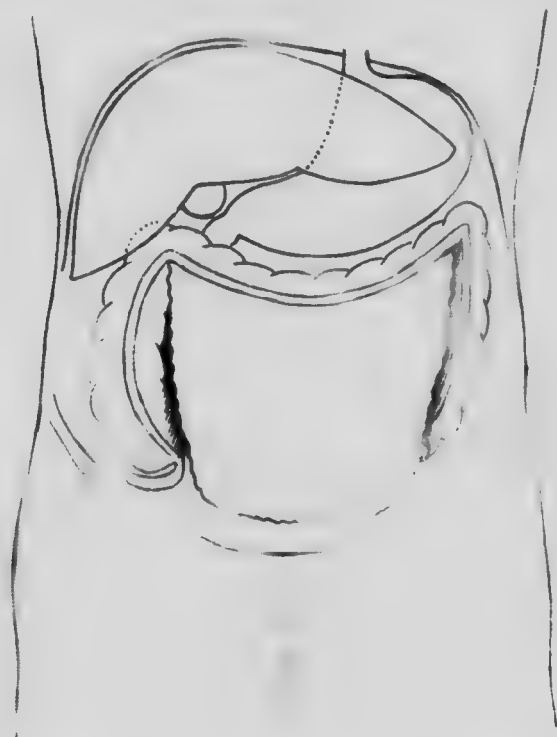
Gall-Bladder.—Several cases are recorded in which enormous thick-walled gall-bladders occupied so much of the abdominal space as to be mistaken for ovarian cysts. Careful search had failed to show any mechanical obstacle.

Common Bile-duct.—On one occasion I saw a young girl operated upon for an abdominal cyst the size of a child's head. It was in the upper part of the abdomen, and on opening it bile escaped. At the post-mortem examination the cyst was found to be due to enormous distention of the common bile-duct. The internal opening of this was normal, and no mechanical obstacle could be found.

Ureters. The enormous double ureter distention of newly-born babies is well-known, and it is also recognized that no satisfactory mechanical explanation of it has been found. At the post-mortem examination. A similar condition may, though rarely, be observed in adults.

SOME FUNCTIONS OF THE STOMACH

A special protective agency exists in the abdomen, but for which many abdominal diseases and operations would be attended by a much higher mortality than they are. The only addition to other uses, may be regarded as the "abdominal policeman" (*Fig. 122*).



NORMAL OMENTUM PROTECTING PAD OVER THE INTESTINES.



FIG. 434. RADICAL CURE OF AN INGUINAL HERNIA BY OMENTUM WHICH HAS OCCLUDED THE HERNIAL SAC.



OMENTUM OCCLUDING HERNIAL SAC.

138 SOME FUNCTIONS OF THE OMENTUM

It travels about in the abdomen with considerable activity, and is attracted, by some sort of information, to neighbourhoods in which mischief is brewing. It may effect a radical cure of hernia, by

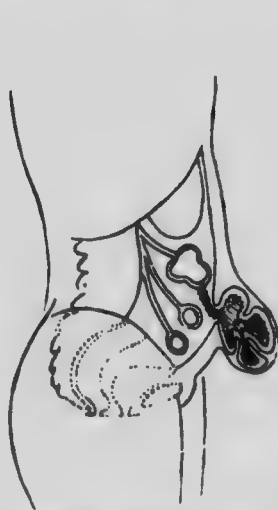


Fig. 125.—OMENTUM OCCLUDING THE SAC OF AN UMBILICAL HERNIA.

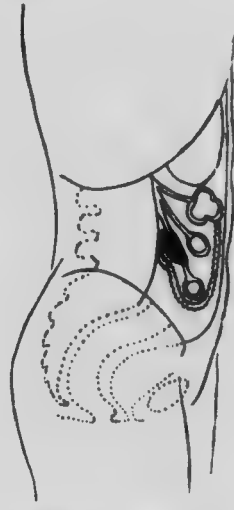


Fig. 126.—OMENTUM GUARDING A SUPPURATING GLAND IN THE MESENTERY OF THE SMALL INTESTINE.

Note that the omentum has found its way to the root of the mesentery, not allowing trifling obstacles to prevent its migrations.

blocking the hernial orifice with an omental plug (Figs. 123, 124, and 125). It surrounds, and adheres to, a recently reduced stran-



Fig. 127.—OMENTUM OCCLUDING A HOLE CAUSED BY INJURY IN THE DIAPHRAGM.

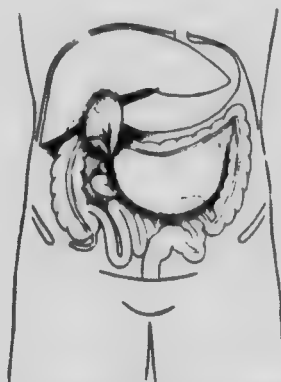


Fig. 128.—OMENTUM ISOLATING A SUPPURATING OR GANGRENOUS GALL-BLADDER.

In acute cases the oedematous vascular omental nest in which the gall-bladder lies is a striking object.

gulated and damaged loop of intestine; and may keep it alive and prevent a leak. It is generally found in the neighbourhood of a diseased or inflamed appendix; by wrapping it up if gangrenous,

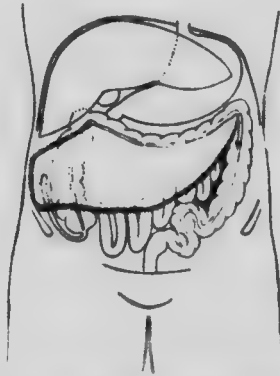


Fig. 129.—OMENTUM ISOLATING THE APPENDIX IN THE FLANK.

An abscess is frequently localized, and pus prevented from escaping into the peritoneum, by the omentum.

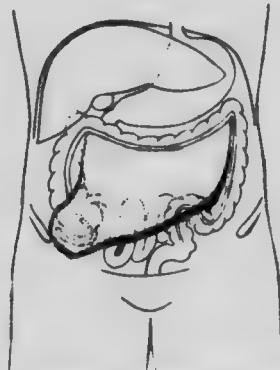


Fig. 130.—OMENTUM ISOLATING THE APPENDIX IN THE ILIAC FOSSA.

The wholly gangrenous and perforated appendix may be so wrapped up in omentum as to prevent its septic contents from escaping into the peritoneal cavity.

or by locking up the pus from an appendix abscess, it may prevent general peritonitis (Figs. 129, 130, and 131). In a similar manner

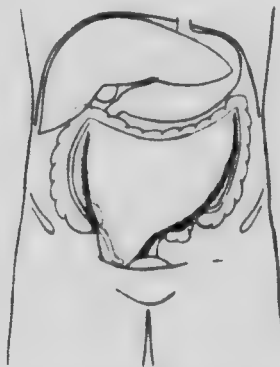


Fig. 131.—OMENTUM ISOLATING THE APPENDIX IN PELVIS.



Fig. 132.—OMENTUM GUARDING A MALIGNANT ULCER OF THE RECTUM.

Note that it has gone to the floor of the pelvis.

it may prevent the perforation of an ulcerating malignant growth (Figs. 132, 133, and 134), of a gastric ulcer, or the death of a

140 SOME FUNCTIONS OF THE OMENTUM

damaged portion of bowel (*Fig. 135*), or the perforation of a suppurating gall-bladder (*Fig. 128*). When it is found covering and closely enveloping an ovarian cyst or a fibroid tumour of the uterus,

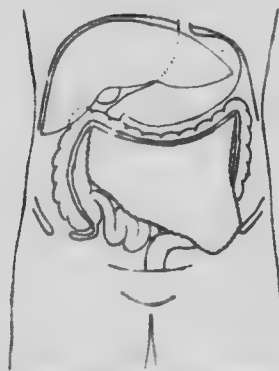


Fig. 133.—OMENTUM GUARDING A MALIGNANT ULCER OF THE SIGMOID FLEXURE OF THE COLON.

It is only when an ulcer is threatening to perforate, or inflammation of the growth has occurred, that the omentum will be found adherent to a cancer. Under ordinary circumstances it appears to avoid contact with it.

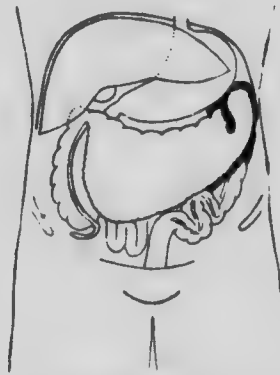


Fig. 134.—OMENTUM GUARDING A MALIGNANT ULCER OF THE COLON.

Some of the most unpleasant surgical surprises are encountered in this connection. The case may be regarded as one of abdominal abscess, and an operation is perhaps lightly undertaken. Separation of the adherent omentum opens the abscess and exposes a septic sloughing malignant growth.

even though not adherent it is safe to assume that something wrong will be found in the tumour. Its effective mobility is shown



Fig. 135. OMENTUM SURROUNDING AN INJURED PIECE OF SMALL INTESTINE.

In less than four hours the omentum will be found attached to damaged intestine, and many lives have been saved by the enveloping omentum.



Fig. 136. OMENTUM ISOLATING A PELVIC TUMOUR, DEGENERATING MYOMA, OVARIAN CYST, ECTOPIC GESTATION, PYOSALPINX, ETC.

The normal relation of the omentum to an ovarian tumour or a fibroid of the uterus is above and around. If it lies in front, or is adherent, this is definite evidence that there is something wrong with the tumour.

SOME FUNCTIONS OF THE OMENTUM 141

by the fact, that, whether the lesion be in the diaphragmatic roof of the abdomen (*Fig. 127*), or on the floor of the pelvis (*Fig. 132*), there the omentum can and does find its way (*Figs. 123 to 138.**)

Another function special to the omentum is an extraordinary capacity for the formation of new blood-vessels. Wherever it adheres new blood-vessels develop with great rapidity, and where the continued need for them arises they may reach a considerable size. I have excised large and well-nourished ovarian tumours deprived of



Fig. 137.—OMENTUM SEALING AN ULCER OF THE STOMACH.

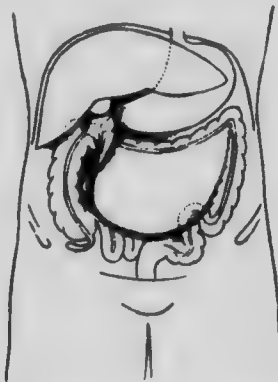


Fig. 138.—OMENTUM SEALING AN ULCER OF THE DUODENUM.

their ordinary vascular supply by an attack of torsion, and depending for their life on large omental vessels. The only uterine fibroids which can attain to colossal size are either retroperitoneal, or depend chiefly upon vessels derived from the omentum for their continued growth. The largest I ever removed was of the subperitoneal variety. It had a thin and narrow pedicle below, but above was capped by omentum, which carried to it at least half a dozen arteries of the size of the brachial.

* These drawings are reprints from the *British Medical Journal*, of January 13th, 1906, and were made for me by Mr. Richardson to illustrate cases we had observed.

INDICATIONS FOR OPERATION.

The most indisputable reasons that can be offered in favour of an operation are (1) *That it is to arrest hæmorrhage*; (2) *To prevent sepsis*; or (3) *To remove a focus of disease*.

1. **Hæmorrhage.**—The blood-flow from any vessel can be immediately arrested by pressure with the tip of a finger on the bleeding point. In order to stop hæmorrhage permanently, the first step should be, to *see* the bleeding point.

Arterial.—It is no longer a rule to tie the bleeding artery above and below the opening, and thus occlude it; and the larger and more important the artery, the worse such a procedure would be. It is possible, by suture, either to close an arterial opening, or to make an anastomosis and conserve the circulation through the vessel.

To *see* the bleeding point may require an extensive operation; but this is usually the lesser of two evils, and generally the only safe course. In certain conditions, the ordinary treatment cannot be carried out.

Bleeding from the Scalp is arrested with difficulty by nature's means, because the great aids to arrest, retraction and contraction of its blood-vessels, cannot occur owing to the density of, and their adhesion to, the tissues of the scalp. For the same reason, a ligature is difficult to apply. If pad-pressure fails to stop the bleeding, it can always be effected by the skilful use of needles and thread, which will act at the same time as ligatures and sutures.

Bleeding from the Palmar and Plantar Arches is usually also an exception to the rule as to seeing the bleeding point. On account of the inelasticity of the parts, even a large incision may not permit of this, while an extensive incision is sure to inflict damage on the important structures underneath the palmar or plantar fasciæ. But the bleeding is likely to be serious, and is unlikely to stop until the bleeding point is effectually blocked. Taking the hand for example, the following steps should be taken:—

1. Apply a tourniquet to the upper arm.
2. Use every means to ensure the absence and prevention of sepsis by the use of cleansing, sterilization, and antiseptics.
3. Pack, carefully but thoroughly, into the bottom of the wound, a small pad of sterile gauze, soaked in iodine tincture. On this place a similar but somewhat larger pad, and on this a larger still, until a thick conical composite pad (graduated compress) projects upwards from the palm. Holding this in position, apply narrow rolls of lint

along the course of the lower two-thirds of the radial and ulnar arteries, on the front of the forearm. (The course of the radial artery is indicated by a line drawn from the middle of the bend of the elbow to the base of the styloid process of the radius, and of the lower two-thirds of the ulnar artery, by a line drawn from the tip of the internal condyle of the humerus to the radial side of the pisiform bone.)

4. Apply a padded splint to the back of the forearm, reaching from the elbow to the tips of the fingers, and bandage it on carefully but firmly, from below upwards, leaving the finger tips exposed.*

5. With the patient in bed, elevate the limb to a position at as nearly a right angle as convenient, and remove the tourniquet. A convenient method of securing elevation is by the application of a long broad strap of adhesive plaster, folded over the end to form a loop; and fixed, over the splint and bandages, to the back and front of the forearm. The loop can then be fastened to a hook in the ceiling, or to the horizontal pole of a French bedstead or other suitable apparatus.

The after-treatment consists in letting the arm down in twenty-hours; taking the splint and padding off the forearm in forty-eight hours, when the patient can be allowed to get up and use a sling. Unless there is pain, or rise in temperature, the dressing need not be disturbed for a week. It can then be soaked off in boracic lotion, and the wound dressed in an ordinary way.

Secondary Hæmorrhage in this situation, as elsewhere, is the result of sepsis, and may be unusually troublesome. The proper treatment for secondary hæmorrhage in ordinary wounds is to try to arrest it with the iodine pad previously described, as a first step; and if recurrence takes place to secure the bleeding vessel with a ligature above and below the opening in it; for a recurrence of bleeding, in these circumstances, admits of no further trifling, and must be tackled. In the hand, as this procedure is not possible, the pads should be reapplied, and the brachial artery ligatured. A similar operation may be required elsewhere, when it is impossible to apply a ligature at the bleeding spot.

Bleeding from an Incised Tonsillar Abscess may be very serious, and is often difficult to stop. A small piece of disinfected sponge dipped in turpentine, packed into and left in the cavity, will occasionally arrest it when all ordinary means have failed.

On one occasion I was asked to see a child two years of age, with hæmatemesis and melæna of one week's duration. It was nearly dead; had a waxy skin; was dropsical from anemia; and fainted

* Complaint that a bandage is too tight must *never* be disregarded. No mistake has been followed by more serious consequences.

when its head was raised. There was no sign of anything wrong in its abdomen. On examination of the mouth, after depressing the tongue, I saw, with the greatest ease and distinctness, a little artery pumping at the bottom of a small crack far back on the dorsum of the tongue. With a thick knitting-needle and a cork, a cautery was improvised which arrested the bleeding at once, and permanently. The child slowly recovered.

Bleeding from the Nose that has resisted the ordinary remedies, keeping the arms raised above the head, pinching the nose, and breathing through the mouth, etc., may be so serious as to demand active measures. At times, with a good illumination, retractors, and sponging, it is possible to see a bleeding vessel on the septum; when this has been blocked the bleeding ceases. More commonly, it is not possible to find the source of the bleeding, and pressure, by some form of dressing, is necessary. For many years, plugging the posterior nares was regarded as the only resort in serious cases; but the discomforts of it were such as to be apt to make the most heroic rebellious; and it was not without danger, for septic inflammation of the middle ear was a not infrequent result. By careful plugging through the anterior nares it is possible to arrest any ordinary hæmorrhage from the nose. Gauze (preferably iodoform-formalin-glycerin), cut in the form of a square of sufficient size, is pushed by forceps pressing on its centre, along the floor of the nose to the back of it. The edges of gauze, at the nostril, are then opened up to display the projecting mouth of the pocket, and the pocket is steadily filled by strips of gauze; first directly backwards, along the floor; next upwards and backwards towards the floor of the orbit; and finally, directly upwards. The hardness of this plug can be increased by pressure on the core, and traction on the edges of the pocket. It is necessary, before leaving the patient, to be sure that blood is not escaping down the throat. Watch for the gulping efforts attending swallowing under such circumstances, and examine the back of the throat.

The same general rule for treatment applies to internal as to external hæmorrhage, namely, *to see*, if possible, the bleeding point; but there are many exceptions to this.

The diagnosis of hæmorrhage if blood is passed from the stomach, bowels, lungs, rectum, bladder, kidney, or uterus, etc., may be easy; but if it is not passed, or cannot escape externally, other signs have to be looked for. The characteristic signs are: pallor—especially noticeable in the lips; a quick and increasingly feeble pulse; anxiety and restlessness; and a cold clammy sweat on the forehead. When these are all present, it is a surgical certainty that the condition is very serious: that hæmorrhage is going on somewhere; and that the only known method of arresting it is to tie the

bleeding point. These three conclusions are wholly true of intra-peritoneal bleeding, because the peritoneum seems to possess similar properties to the intima of the blood-vessels, and to delay blood-clotting; but experience proves that they are not to be regarded as a demand for surgical activity in the great majority of cases in which blood escapes externally. For example, bleeding from the stomach, however sudden and severe, is seldom fatal; and the bleeding rarely fails to cease spontaneously. If it recurs, it may do so several times without a fatal result. Without this knowledge, a surgeon would conclude that such a severe sudden bleeding came from a vessel so large that spontaneous arrest was impossible; and that recurrence, like the secondary hæmorrhage he was accustomed to deal with, was the result of sepsis; and that, after a single return, it was sure to appear again and again, until death followed. Not only centuries of experience, but operative calamities, have been necessary to convince some surgeons that these conclusions might be wrong. It is, however, now generally agreed that recurrent hæmorrhage from gastric ulcer is an indication for gastro-enterostomy, and one of the best reasons for performing it.

2. Sepsis.—Such empirical rules as "Trephine in all compound fractures of the skull," and "Sutures in scalp wounds are dangerous," were based upon the experience that trephining added to the chance of recovery (it did so by diminishing the chance of septic meningitis); and that suture of scalp wounds was more frequently followed by erysipelas, suppuration, and other septic complications, than when the wounds were left open. Neither of these rules would be accepted as a guide to practice now; but operations on the head are still necessary for the prevention of sepsis. It is impossible to exaggerate the importance of thorough exploration, except for the most trivial scalp wound. But for a rule based upon this knowledge, *always to feel or to see the bottom of the wound*, it is certain that foreign bodies will continue to be left in scalp wounds, and that punctured and perforating fractures of the skull and brain will be found as an unpleasant surprise at post-mortem examinations. An injury to the head, which is to be fatal in four days, may leave a patient "quite well," and "fit for anything." Operation on these cases, for the prevention of sepsis, will save many lives.

CASE 6.—A schoolboy, aged 16, was firing a toy cannon which burst. An hour later I saw him with what was regarded as, and appeared to be, a trivial scalp wound over the right frontal eminence near the margin of the hairy scalp.

He made no complaint; talked and looked well, and walked some distance with me to a private hospital. A probe, introduced into the wound.

entered the skull through a punctured fracture. A disc of bone was removed with the trephine, and the breach of the cannon was found lying in a hole in the dura mater. (It consisted of a piece of iron, a quarter of an inch long, and of the diameter of the end of my little finger.) Several portions of depressed fragments of the inner table were also removed from the right frontal lobe of the brain. The wound was sutured with long untied silkworm-gut sutures, and packed with antiseptic gauze. Next day, the temperature and pulse were normal, and the condition of the wound was satisfactory; consequently, the gauze was removed, and the sutures were permanently tied. Recovery.



Fig. 139. PHOTOGRAPH SHOWING WOUND OF FACE FROM WHICH THE PIECE OF HAY FORK, AS SHOWN ON THE OPPOSITE PAGE, WAS EXTRACTED.

CASE 7.—Two years before admission to my wards in the Royal Infirmary, a boy, aged 10 years, had fallen off a hay-cart, and was carried home unconscious. He was carrying a hay-fork at the time, and this was found to be broken. A large wound on the right side of the scalp and face was cleansed and sutured, not probed, and it healed by first intention.

Two years later, the wound "began to gather." A small abscess formed and healed, and after a few months a black object protruded through the skin (Fig. 139). A piece of hay-fork four and a half inches

long was, to the surprise of every one concerned, readily withdrawn from the wound (*Fig. 140.*) It had apparently passed through the antrum of Highmore, and crossed the back of the naso-pharynx to the opposite side.

The boy fortunately suffered no ill effects; but his case conveys a useful lesson.



Fig. 140.—FOREIGN BODY (Piece of Hay Fork).

Removed from wound in head of boy more than two years after an injury.

The majority of compound fractures that go wrong, at the present day, are those with "a very small wound which was sealed with collodion." Operation, for the removal of foreign bodies and dirt, would have prevented sepsis and saved many useful limbs.

Injuries and wounds of the abdominal parietes may be complicated by lacerated wounds of the viscera and internal hæmorrhage in patients who "have only been winded, and have now quite recovered." Unless a rule is adopted that an operation shall be done to see the full extent of the wound (the peritoneum must, of course, not be opened unless it has been perforated), many lives will be lost by preventible sepsis.

CASE 8.—During the period of office of Dr. Coates as my house-surgeon, I was leaving the Infirmary after a hard morning's work (5th June, 1902). We met at the door a patient walking with a friend. They had come six miles to the Central Station by train. It would have been difficult to say which was the patient and which the friend, for neither looked as if there could be much wrong. Their story was, that they had been playing with cartridges and the fire, three hours before, and an explosion had driven something against the patient's abdomen causing a small wound, which bled a good deal and made him faint. The patient asked that a dressing should be applied; that he should be allowed to return home at once; and he resented the suggestion that there might be some serious damage done, or that any operation was necessary.

On enlarging the wound, a hole was found leading into the peritoneal cavity. On extending the opening, free bleeding was seen to be going on, and more than a pint of blood had already escaped into the abdomen. The source of it was traced to an artery, pumping in the omentum; and this had been divided by the brass end of a cartridge, three-quarters of an inch square, which was found lying in contact with it. The artery was ligatured; the foreign body removed; the peritoneum and the wound were cleansed; and recovery followed.

The dangers of septic foci, and the importance of operations for their removal, are not yet sufficiently recognized. The majority of cases of ill-health; a great number of diseases not associated with their true origin (e.g., varieties of arthritis); and many deaths, arise from sepsis, which can only be prevented by removal of the focus of infection. Mouth, ear, throat and nose sepsis, for example, deserve more recognition than they have yet received.

The mortality and ill-success of operations is now chiefly dependent upon the failure to realize, or inability to act upon the belief, or both, that prevention of sepsis should be an all-sufficient indication for operation.

Surgical tuberculosis is rarely fatal except from septic complications, and these can usually be prevented by operation. The kidney destruction, and the mortality following bladder and kidney operations, result from these operations being left undone when they might have prevented sepsis.

Delay, till sepsis has got so good a hold that it cannot be arrested, is the cause of 90 per cent of the mortality after operations for appendicitis, gall-stones and intestinal obstruction.

3. **To Remove a Focus of Disease.**—For a variable time, often for long, disease remains localized to the spot in which it started. Operation at this period is likely to prevent further infection and *generalization*. Sepsis, tubercle, and cancer, each supply abundant evidence as to the truth of this, and to the failure of the most heroic operations undertaken at a later stage.

The Surgical History of ovariectomy may offer a useful lesson for future guidance. Twenty-five years ago, ovarian tumours removed by operation were of colossal size; and the mortality of the operation was not less than 25 per cent. So long as it remained at that, a dread of the risk kept patients from seeking relief, till the necessity for it was apparent to all. Hence the size and complications of the tumours. Ten years later, many women with pelvic pain had their ovaries removed. The chief reasons were that, as nothing else was found to account for their pain, therefore the ovaries must be at fault; and the technique of the operation had made such strides that it was now safe to remove them. Pathologists generally discovered something wrong in the excised ovaries; but the patients found, after recovery from the operation, that not only was the pain still there, but other troubles had developed in addition. This is a frequent after-history when operations of any sort have been performed for the relief of symptoms in the absence of physical signs of gross disease. At the present time, it is known that ovarian tumours seldom remain stationary, but as a rule make steady progress; that many contain cancer locked up in them; that their diagnosis at any stage is easy, when there is a definite tumour; that their removal is safe, and that the results are then satisfactory.

* * * * *

True advance in surgery is, to a certainty, not to be expected in the direction of bolder operating; but through increased knowledge of etiology, pathology, diagnosis, and prognosis; so that the earliest manifestations of disease may be recognized in time to prevent the serious happenings so frequently dealt with now.

X-RAYS.

The advantages of x-rays as an aid to diagnosis and treatment are even yet not sufficiently appreciated.

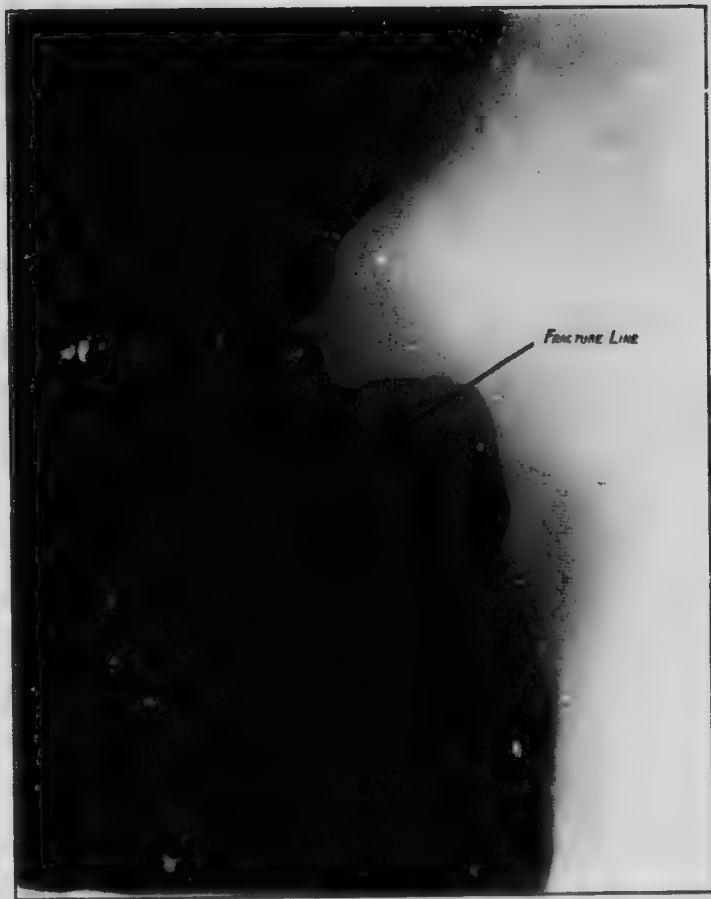
The following photographs (Figs. 141 to 146) are intended to illustrate these points.



Fig. 141.—"SPRAINED WRIST."
Colles' fracture, impacted little deformity.



Fig. 142.—"SPRAINED WRIST."
Showing fracture of scaphoid bone, also Colles' fracture.



*Fig. 143 - EXTRA CAPSULAR FRACTURE OF THE NECK OF THE FEMUR.
"Contused Mps." Patient able to walk.*

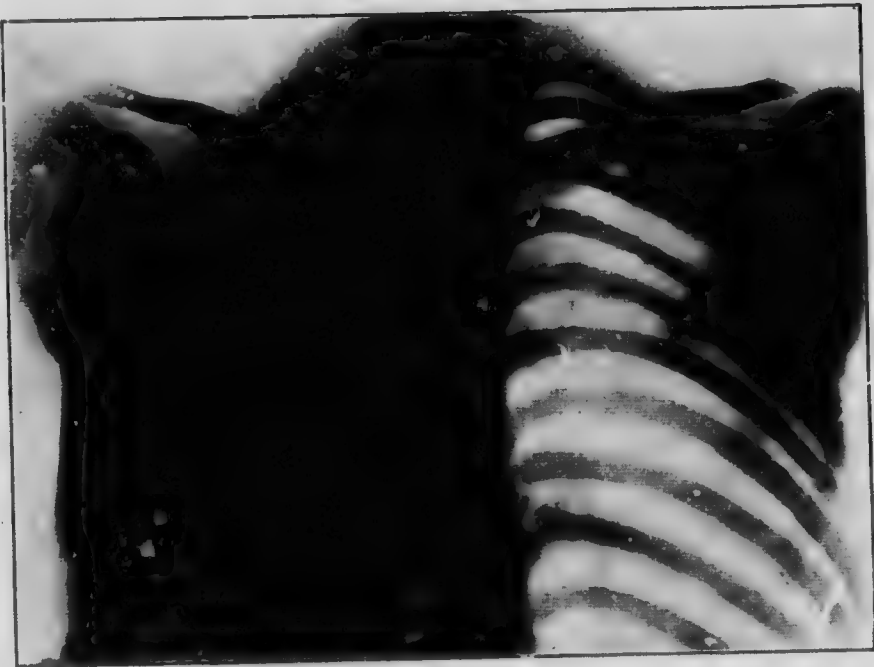


FIG. 144. - METAL PENCIL CASE IN RIGHT BRONCHUS.
Removed after performance of low tracheotomy



Fig. 148. -TOOTH PLATE IMPACTED IN THE ESOPHAGUS.



FIG. 146. — ACUTE SEPTIC OSTEITIS OF THE METACARPAL BONE OF THE RING FINGER.

An illustration of the aphorism — There is no such thing as an acute primary cellulitis in children. Always look for a home focus. The child was sent into the infirmary with "cellulitis of the hand and forearm."

INDEX.

	PAGE		PAGE
ABDOMINAL pain, causes of	130	BACILLI	19
— — — characters of	130	Bacteria , action of, in wounds	20
and pelvic viscera, the	111	— conditions of growth of	19
acute inflammation of	111	— destruction of	20
cause of colics of	112	diffusion of, in body	20
chronic inflammation of	112	divisions of	19
colics of	112	general changes produced by, in	
a course of	112	body	2
effect of complete obstruction on the cæcum	115	local changes produced by, in	
gall-bladder	114	body	20
urinary bladder	114	localization of, in body	20
inflammation and obstruction on hollow viscera	110	where found in nature	20
partial obstruction on		Bandage , dangers of tight	143
gall-bladder	113	Bedsore s and gangrene	44
stomach	113	Bile-duct , idiopathic dilatation of the	136
urinary bladder	112	Bleeding , tendency to, chiefly an	
gangrene of	116	individual character	103
gall-bladder	116	Blood as a defence against micro-	
intestine	117	organisms	22
urinary bladder	116	Blood , transfusion of, in cancer	95
vermiform appendix	117	Bone injuries, association with	
the hollow viscera	112	pyæmia	8
reaction to stimuli of	112	CALCULI	121
tubercle of	112	Calculus behaves as a foreign body	121
Abscess , causes of	17	cause of symptoms of	121
course of	17	bladder	121
healing of	17	renal	121
delayed healing of	17	large, symptoms of	123
signs of	18	prognosis of	123
Acute inflammation, causes of	10	symptoms of	121
method of causation	10	treatment of	123
Agglutination as a defence against		Callous ulcers, treatment of	40
micro-organisms	22	Cancer	83
Antibacterial defence against micro-		absence of early pathognomonic	
organisms	22	signs	90
Antiseptic , definition of	19	characters of the tumour of	88
Antitoxins	22	chorion epithelioma, peculiarities	
Appendicitis , association with pyæmia	12	of	89
Arthritis , pyæmic	15	classification of	88
in relation to other joint		columnar-celled	89
diseases	15	en cuirasse	89
Asepsis , definition of	19	diagnosis of	89
		electricity in	94
		epithelioma	88

	PAGE		PAGE
Cancer, epithelioma, secondary glandular infection	85	Erysipelas, causes of	28
- exciting cause of	87	- course of	28
- favourite sites of	88	- duration of	29
- general condition as an aid in diagnosis	92	- incubation period	29
- importance of chronic irritation	91	- prognosis of	29
- discovery of tumour	91	- signs of	28
- hæmorrhage	91	- symptoms of	28
- precancerous conditions	93	- treatment of	29
- signs of stricture	91	- varieties of	29
- infection of glands	87	FEVER, general inflammatory	7
- methods of commencing	87	Fibrosis as a defence against micro-organisms	22
- open-air treatment of	95	- in malignant diseases	58
- palliative operations	94	Fistula, definition of	17
- points in prognosis	92	Function, impairment of	5
- predisposing causes of	83	GALL-BLADDER, idiopathic dilatation of the	136
- principles of radical cancer operations	93	Gangrene of abdominal and pelvic viscera	116
- prognosis of	92	- acute infective localized	41
- rodent ulcer	88	- causes of	42
- secondary growths, characters of	88	- signs of	42
- chief seats of	88	- treatment of	42
- spheroidal-celled	89	- spreading	42
- spontaneous healing of face epithelioma	88	- causes of	42
- transfusion of blood in	95	- prognosis of	42
- treatment of	93	- signs of	42
- by operation	93	- treatment of	42
- ulcer characters of	88	and bedsores	44
Cellulitis, diffuse suppuration, causes of	18	- best method of amputation in	53
- general symptoms of	18	- cause of clinical differences between dry and moist	44
- local signs of	18	- causes, exciting	43
Chronic inflammation, causes of	16	- predisposing	43
Cocci	19	- circulation in, methods of testing clinical differences between dry and moist	44
Colon, idiopathic dilatation of the	134	- diabetic	48, 52
Congenital syphilis	70	- difference between ordinary and infective, involving prepuce	42
- general appearance	71	- from embolism	44
- later signs of	71	- experimental, to produce dry	43
- signs of	70	- to produce moist	43
- in anus and genitals	70	- from frostbite, treatment of	51
- in bones and joints	71	- fully-developed, treatment of	50
- in mouth	70	- of gall-bladder	116
- in skin	70	- of intestine	117
- in skull	70	- from ligature and embolism	51
Contusions, dangers of	104	- line of demarcation	40
- signs of	104	- method of prevention of moist separation of dead from living part	40
- terminations of	104	- natural amputation, defects of	40
- treatment of	104	- essential difference from infective	42
DIABETIC gangrene	48, 52	- relation to vascular supply	42
Echymosis, large, suggest fracture	104		
Electricity in cancer	94		
Embolism and gangrene	44		
Epistaxis, plugging nares	144		
Erysipelas	28		

INDEX

159

	PAGE		PAGE
Gangrene, premonitory signs of dia-		Hollow viscera, essential differences	
betic	48	between diverticula and	
Raynaud's disease	48	sacculi	119
senile	48	diverticula and sacculi	119
senile	52	pathological changes in diver-	
and slough	42	ticula and sacculi	120
summary of causes of	45	and clinical results of	
threatening, treatment of	48	diverticula and sacculi	120
traumatic, treatment of	50	reaction of, to calculi	117
treatment of	48	to foreign bodies	117
and ulcers	32	of symptoms produced	
of urinary bladder	116	by calculi	117
vermiform appendix	117	reasons why diverticula and	
Glands, cancer infection of	87	and sacculi are confused	119
Gleet	31	Idiopathic dilatation	131
Gonococci, clinical course of	29	acute	131
duration of anterior	30	of common bile duct	136
methods of spread	29	chronic	136
Gonorrhœa	29	of gall-bladder	136
abortive treatment of	30	ureters	136
affecting posterior urethra	31	urinary bladder	135
cause of	29	uterus	136
complications of, in men	31	Indications for operation, to remove	
in women	32	a septic focus	149
general complications of	32	Infection, microbic	20
modes of infection	29	septic	63
and sterility	32	Infective organisms, clinical signs of	
treatment of	30	special infection	10
in women	31	Inflammation, causes of	1
HÆMOPHILIA	103	exciting	1
history of typical case	103	predisposing	1
Hæmorrhage, arterial	142	as a defence against micro-	
in cancer, importance of	91	organisms	22
internal signs of	144	definition of	1
intraperitoneal	144	due to traumatism, rheumatism,	
from nose	144	and gout	17
operation for arrest of	141	exciting causes	1
from palmar and plantar arches	142	general predisposing causes	1
treatment of	142	general signs of	15
from scalp	142	heat in	13
secondary	143	local predisposing causes	1
from palm, treatment of	143	loss of function in	15
treatment of	143	pain in	4
from stomach	144	character of	5
treatment by gastroenter-		tender spot in	15
ostomy	145	pathological	2
from tongue simulating hæma-		physiological	1
temesis	143	redness in	13
from tor-silar abscess	143	results of	3
treatment of	144	signs of	3
Hæmorrhoidal vein, association with		signs of local	3
pyæmia	13	swelling in	13
Healing	2	terminations of	15
Hodgkin's disease	58	general	17
Hollow viscera, characters of a		local	15
diverticulum	119	Intestine, idiopathic dilatation of	131
sacculus	119	inversions of the	123

	PAGE		PAGE
Intestine, torsions of the	126	Open-air treatment of cancer ..	95
Inversions	123	Operation for arrest of hæmorrhage	141
— acute and chronic	124	— indications for	141
— causes of	123	Opsonic index	23
— essential cause of differences		Ovariectomy, history of, as a guide	
between acute and chronic ..	124	to the requirements of ad-	
— of the intestine	123	vance in surgery	149
Iodine, glycogen reaction	23		
		PARALYTIC ileus	132
JOINTS, sarcoma of	100	Pathological inflammation, causes of	12
— and viscera, pyæmic abscesses in	13	— phenomena of	2
		Primary focus, importance of, in	
KELOID and Sarcoma	97	pyæmia	14
		Primary syphilis	65
LEUCOCYTOSIS	21	Psoas abscess, operative treatment of	80
— aid of in diagnosis and prognosis	21	Puerperal fever, association with	
Lungs, embolism of sarcoma in ..	97	pyæmia	13
Lymphatic glands, sarcoma of ..	98	Pyæmia	8
		— arrest of, by ligature of veins ..	14
MALIGNANT disease	82	— association with appendicitis ..	12
— definition of	82	— bone injuries	8
— general consideration of	53	— hæmorrhoidal vein	13
Mastoid disease, association with		— mastoid disease	13
pyæmia	8	— puerperal fever	13
Melanotic cancer	98	— causes of	8
Micro-organisms, defences of body		— clinical signs of	13
against	22	— importance of primary focus ..	14
— agglutination	22	— repeated rigors	14
— antibacterial substances ..	22	— natural prevention of, by throm-	
— blood	22	bosis	13
— fibrosis	22	Pyæmic abscesses in viscera and	
— inflammation	22	joints	13
— phagocytosis	22	— arthritis	15
— skin	22	— relative to other joint diseases	15
Middle-ear suppuration, cause of		— comparison with acute and	
pyæmia	8	gonorrhœal rheumatism	15
Molluscum fibrosum in relation to		— resemblances to acute and gonor-	
sarcoma	96	rhœal rheumatism	15
NARES, plugging of the	144	RECTUM, ballooning of	134
Nose, to arrest bleeding from ..	144	Repair, characters of	1
		Repair of special parts	2
(ESOPHAGUS, idiopathic dilatation of		Rigors in pyæmia	13
the	131		
Omentum as the abdominal police-		SAPRÆMIA	7
man	136	Sarcoma, classification of	98
— effective mobility of	140	— desmoid, of abdominal wall ..	96
— ferrets out seat of trouble ..	138	— diagnosis of	99
— some functions of the	136	— bone by x-rays	99
— protection of, in appendicitis ..	139	— embolism of	97
— as a protection to damaged		— in lungs	97
intestine	138	— exceptional methods of dis-	
— fibroid tumour of uterus ..	140	semination	98
— gall-bladder	14	— and injury	97
— ovarian cyst	140	— of joints	100
— ulcers	139	— and keloid	97
— radical cure of hernia	138	— of lymphatic glands	98
— travels of the	138	— melanotic	98

INDEX

161

	PAGE		PAGE
Sarcoma, nature of secondary deposits	98	Suppuration	17
— no age limit	96	— diffuse, course of	18
— predisposition to, by certain simple tumours	96	— of middle ear, cause of pyæmia	8
— the primary lesion of	97	— signs of	18
— prognosis of	100	Syphilis, cause of	64
— reasons for lymphatic dissemination	98	— character of primary sore	65
— its relation to certain scars	96	— congenital	70
— — to molluscum fibrosum	96	— — general appearance of	71
— — to tooth sepsis	97	— — signs of	70
— results of experimental work on treatment of	102	— diagnosis of chancre	65
— symptoms and signs	100	— — secondary lesions	66
— of testicle	98	— general considerations of	53-64
— tonsil	98	— gummata of bones	68
— treatment of	102	— — muscle	68
— — by alternative methods, x-rays and Coley's fluid	102	— — skin	68
— — desmoid tumours	96	— infectiveness of	71
— — by operation	102	— late secondaries	66
— usual methods of dissemination	97	— marriage in	74
Sarcomata	95	— methods of contracting	64
— essential similarity to cancers	95	— primary	65
— histological characters	96	— prognosis in	74
— predisposing causes	96	— secondary	65
Scalp, hæmorrhage from, to arrest wounds, importance of thorough exploration of	142	— stages of	65
— — sepsis of	145	— tertiary	65, 67
Secondary syphilis	65	— — gumma	67
Senile gangrene	48	— of blood-vessels	69
Sepsis and abdominal injuries	146	— brain and spine	69
— compound fractures	146	— eyes	69
— definition of	19	— mouth	68
— old aphorisms concerning	145	— nose	69
— prevention and arrest of, by operation	145	— rectum	69
— of scalp wounds	145	— viscera	69
— still the greatest danger of operations	149	— signs of	67
— tubercle, and malignant disease, importance of disease focus in	149	— treatment of	72
— foci, dangers of	147	— — condylomata	73
Septic focus, indications for removal of	149	— — constitutional	72
Septicæmia	17	— — infants	73
Sinus, definition of	17	— — iritis	73
Skin, the, as a defence against micro-organisms	22	— — local conditions	73
Spirilla	19	— — in mouth	73
Sterilization, definition of	19	— — skin	73
Stomach, acute dilatation of	131	— — throat	73
— — idiopathic dilatation of the	131	— nervous symptoms	73
Strangulation in hernia	131	— primary sore	72
Stricture as sign of cancer	91	— tertiary	73
Subacute inflammation, causes of	16	— Wasserman reaction	71
		Syphilitic ulcers, treatment of	41
		TEMPERATURE and pulse	23
		Tertiary syphilis	65
		Testicle, sarcoma of	98
		Tonsil, sarcoma of	98
		Tonsillar abscess, bleeding, to arrest	143
		Tooth, septic, and sarcoma	97
		Torsion, commencement of the attack	130
		— importance of length of pedicle in	131
		— progress of	130

	PAGE		PAGE
Torsion, repeated attacks of	130	Ulcer, diagnosis of	33
— strangulation in	131	— from base	37
— treatment of	131	— character of discharge	36
Torsions	124	— character of surrounding	
— causes of	129	skin	35
— complete volvulus	126	— condition of patient	34
— direction of	129	— edge	37
— of intestine	126	— locality	34
— necessary requirements for	126	— multiplicity	35
— of ovarian tumours	126	— pain	38
— partial volvulus	127	— shape	35
— pathological changes	129	— general treatment of	39
— primary	126	— ideal treatment of	41
— secondary	127	— local treatment of	39
— sigmoid volvulus	127	— Martin's bandage, method of	
— symptoms of	130	application	40
Toxins	224	— predisposing causes of	33
Tubercle, general considerations of	53	— and skin grafting	38
Tuberculin, treatment of tuber-		— treatment of	38
culosis by	78	— special, callous, tuberculous	
Tuberculosis	74	and syphilitic	40, 41
— aids in diagnosis of	77	— varieties of	33
— Bier's treatment	79	Ureters, idiopathic dilatation of the	136
— cause of	7	Urinary bladder, acute dilatation of	135
— cold abscess	75	Uterus, idiopathic dilatation of the	136
— composition of a tubercle	75		
— course of tubercle	75	VACCINES	224
— diagnosis of cold abscess	75	Viscera and joints, pyæmic abscesses	
— size and source of sinus	76	in	13
— general treatment of	78	Volvulus of the intestine	126
— injection treatment of	79		
— local treatment of	79	WOUNDS	104
— at different ages	79	— accidental, dressing of	111
— mode of entrance	74	— treatment of	109
— natural cure of tubercle	75	— aims of surgeon in	108
— operative treatment of	80	— aseptic	105
— Psoas abscess	80	— avoidance of irritants in	108
— opsonic index of	78	— classification of	105
— pathology and formation of cold		— continuous elastic pressure in	107
abscess	75	— differences from contusions	104
— predisposing causes	74	— divisions of	104
— preventive operation	82	— healing, methods of	105
— treatment of, by tuberculin	78	— methods of preventing sepsis in	105
— type of patients	75	— retention of heat in	108
Tuberculous ulcers, treatment of	40	— treatment of, antiseptic method	106
Tumour as sign of cancer	91	— treatment of, general principles	105
Tumours, ovarian, torsions of	126	— treatment of, Lister's methods	106
ULCER, extending or healing ?	38		
— and gangrene	32	X-RAYS as an aid to diagnosis and	
— causes of defective blood supply in	32	treatment	150

	PAGE
..	33
..	37
..	36
ing	
..	35
..	34
..	37
..	34
..	35
..	38
..	35
..	39
..	41
..	39
of	
..	40
..	33
..	38
..	38
us	
40, 41	
..	33
he	136
of	135
e	136
..	224
es	
..	13
..	126
..	104
..	111
..	109
..	108
..	105
..	108
..	105
..	107
..	104
..	104
..	105
..	105
..	108
..	106
..	105
..	106